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[1] Deceased.

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The edition of authors' separates from the present volume was 250, of which 100 were for the authors, 100 for the Library exchange list, and 50 were placed on sale with the Librarian. Of several of the articles an additional 100 copies were ordered by the authors.

The distribution of the Bulletin in signatures has been discontinued.

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BULLETIN

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AMERICAN MUSEUM OF NATURAL HISTORY.

VOLUME XIII, 1900.

Article I.—THE MOUNTAIN CARIBOU OF NORTHERN BRITISH COLUMBIA.

By J. A. ALLEN.

The Museum has recently received, through the liberality of Mr. James M. Constable, a series of specimens of the Mountain Caribou of northern British Columbia, recently described by Mr. Ernest Seton-Thompson, under the name *Rangifer montanus*.[1] Mr. Seton-Thompson characterized the species from a mounted specimen in the museum of the Canadian Geological Survey at Ottawa, "taken in the Illecillewaet watershed, near Revelstoke, Selkirk Range, B. C., in 1889." The specimens here described were taken by Mr. A. J. Stone during his recent expedition to British Columbia and the Northwest Territory in the interest of the American Museum of Natural History, under the patronage of Mr. Constable. They were killed in the Cassiar Mountains, about sixty miles south of Dease Lake, September 15–26, 1897. It was then too late in the season to get them further than the trading house at Dease Lake till the following spring, and owing to other accidental delays they did not finally reach the Museum till November, 1899, more than two years after they were collected.

Mr. Stone, writing to me of these specimens, under date of June 30, 1898, from Fort Simpson, N. W. T., says: "In a conversation with you while in New York in April, 1897, you expressed a belief that there existed a third variety of the Caribou in the Northwest, but I could not flatter myself with reaching them so easily." He further refers to its large size, and says he

[1] The Ottawa Naturalist, Vol. XIII, No. 5, August, 1899, pp. 129, 130.

considers them to be as much larger than the Woodland Caribou of Canada and Maine, as the latter is larger than the Barren Ground Caribou. It happened, however, that while this fine series of six specimens was en route to the Museum, the species was described and named, as above stated. Although there are various important discrepancies between the measurements given

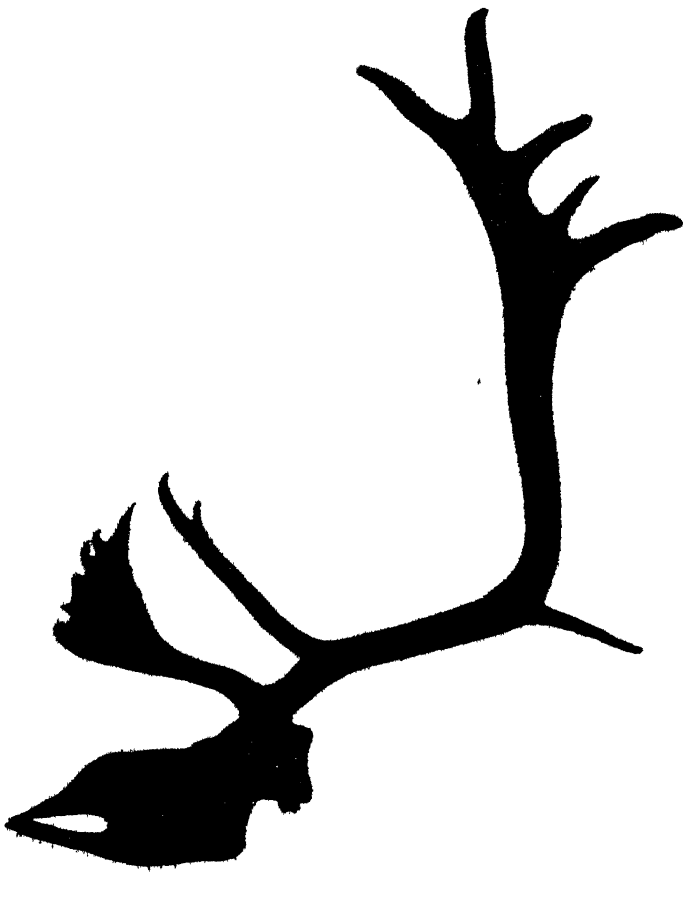

Fig. 1. *Rangifer grœnlandicus*, ♂ ad, No. 10197, Holsteinborg, Greenland; Prof. L. L. Dyche. ⅙ nat. size.

by Mr. Seton-Thompson from a mounted specimen and those taken from specimens in the flesh by Mr. Stone, there is apparently no good reason for not considering the two forms as

Fig. 2. *Rangifer montanus*, ♂ ad., No 15714, Cassiar Mts., B. C.; A. J. Stone. ⅓ nat. size.

specifically identical, the discrepancies in measurements being doubtless due to the faulty taxidermy of the mounted specimen

With Mr Stone's series of specimens before me, it seems desirable to supplement the original description with a further account of the species, and to add thereto Mr Stone's excellent field notes on its habits and distribution

Rangifer montanus *Seton-Thompson*

MOUNTAIN CARIBOU

Rangifer montanus SETON THOMPSON Ottawa Naturalist XIII No 5 Aug, 1899, 129 Selkirk Range near Revelstoke, B C

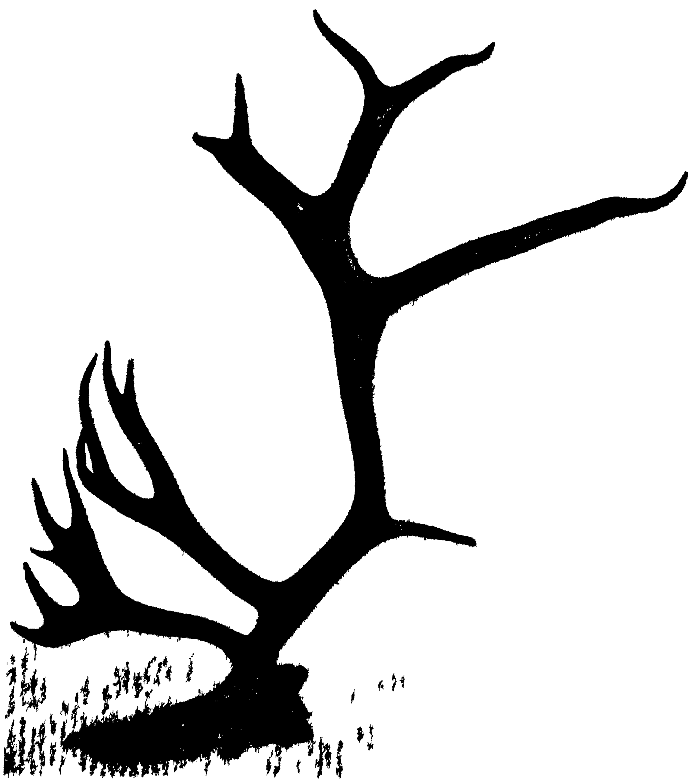

Fig 3 *Rangifer montanus*, ♂ ad Cassiar Mts, B C Coll A J Stone ⅛ nat size

Adult Male, in September.—General color above clove-brown, darkest on the head, back, thighs, and lower edge of the sides of the chest, and still darker, blackish brown, on the breast and limbs; muzzle, including the whole end of the nose and front border of the lower lip, silvery grayish white, succeeded by a broad band of blackish brown, which fades posteriorly on the sides of the head and below into the general color, but extends broadly over the front part of the head to the eyes; neck all round brownish gray, lighter on the sides than above, becoming nearly white in front; the gray color of the sides of the neck extends posteriorly over the anterior part of the shoulders, and is continued as an ill-defined broad band on the sides of the chest; ventral surface, from the chest posteriorly, grayish white, passing into pure white posteriorly and on the inside of the thighs; rump patch white, large and sharply defined; tail above centrally dark brown like the back, broadly edged and tipped with white; a narrow band of pure white borders the hoofs; ears externally dark brown, mixed with gray and edged with blackish; internally much lighter, becoming light gray at the inner base. In one specimen there is a broad band of whitish gray above and below the eye, forming an imperfect eyering; but this seems exceptional, and is probably a remnant of the summer coat, the majority of the specimens having the eye region dark like the adjoining parts of the face.

The female does not appear to differ materially from the male. The young of the year, however, is much lighter than the adult, having the whole ventral area white, and the whole neck and the sides much lighter; the dark color of the upper parts is lighter and restricted in area to the middle of the back from the shoulders posteriorly; the tail is all white except at the base above.

Measurements.—The following are the collector's measurements taken from the freshly killed specimens before skinning, to which are added, for comparison, the measurements of the type specimen, from a mounted example, as given by Mr. Seton-Thompson.

	No. 4[1] ♂ ad.	No. 5 ♂ ad.	No. 6 ♂ ad.	No. 7 ♂ ad.	No. 8 ♀ ad.	No. 9 ♀ juv.	Type, ♂ ad.
Total length	2083	2057	2210	2172	1930	1499	2413
Tail	152.4	152.4	152.4	152.4	177.8	114.3	127
Height at shoulder	1321	1270	1346	1397	1245	991	1081
Hind limb to hip	1295	1334	1245	1359	1145	965	....
Length of hind foot	610	635	635	597	597	522	660
Fore leg to elbow	597	584	610	646	521	432	....
Width of chest	326	326	368	368	305	229	....
Depth of chest	775	787	787	749	711	610	....
Ear[2] from crown	....	....	140	140	....	....	190.5
" " notch	....	....	115	120	....	....	....

[1] Collector's numbers. No. 6 = Mus. No. 15714; No. 8 = Mus. No. 15715; No. 9 = Mus. No. 15716. The original measurements, given in inches, are here reduced to millimetres.

[2] Measurements from dry skins, exclusive of hair.

Skull. — In addition to its large size, the skull of *R. montanus* is peculiar in the unusual elongation of its facial portion. The antlers are similar in length and proportions to those of the Barren Ground Caribou, but more massive, with the palmated portions much broader and heavier. (See Figs. 1–6.)

COMPARATIVE MEASUREMENTS OF SKULLS OF CARIBOU.

	R. montanus.		*R. grœnlandicus.*			*R. terræ-novæ.*
	♂ ad.[1]	♀ ad.[2]	♂ ad.[3]	♂ ad.[4]	♀ ad.[5]	♀ ad.[6]
Basal length	420	360	364	375	305	350
Tip of premaxilla to tip of nasal	125	100	109	115	84	88
Tip of premaxilla to alveolus of first premolar	148	126	122	121	99	114
Length of nasals	123	122	94	111	97	124
Greatest orbital breadth	182	156	168	164	152	157
" anteorbital breadth (above m^2)	127	113	117	115	106	93
" zygomatic breadth	148	136	144	141	126	126
Mastoid breadth	149	116	128	126	101	112
Palatal breadth at m^1	73	62	72	61	56	54
Distance between tips of paroccipital processes	89	80	72	64	63	77
Depth of skull between antlers	112	86	102	94	77	82
Length of upper toothrow (crown surface)	99	97	89	98	81	92
Diastema (canine to pm^1)	72	59	60	55	52	55
Distance between antlers just below burr	78	53	45	64	57	61
Distance between outer edge of antlers just below burr	135	95	125	116	84	102
Length of mandible, incisive border to angle	330	280	283	280	256	255
Angle to condyle	109	102	106	106	83	95
" " tip of coronoid	148	137	146	148	115	128
Depth of mandible at m_3	38	31	35	32	28	29
Length of lower toothrow	103	103	105	97	96	97
Diastema	130	108	99	100	87	95
Antlers, length of main beam	1235	405	1246	1000	400	580
" distance apart at point of palmation	875	146	973	860	255	335
" distance between tips of front tine	790	—	687	655	320	194
" breadth of points at tip of main beam	415	100	315	278	65	320
	555	—	410	575	—	—

[1] Collector's No. 7, ♂ ad., Cassiar Mts., northern British Columbia, Sept., 1897, A. J. Stone.

[2] Museum No. 15715, ♀ ad., Cassiar Mts., northern British Columbia, Sept., 1897, A. J. Stone.

[3] No. 10197, ♂ ad., Holsteinborg, Greenland, Prof. L. L. Dyche.

[4] No. 10198, ♂ ad., Holsteinborg, Greenland, Prof. L. L. Dyche.

[5] No. 14936, ♀ ad., Northern Greenland, Lieut. R. E. Peary.

[6] Adult ♀, Humber River, Newfoundland.

Fig. 4 (upper figure). *Rangifer montanus*, ♂ ad., Cassiar Mts., B. C.; Coll. A. J. Stone. ⅛ nat. size.
Fig. 5 (lower figure). *Rangifer montanus*, ♂ ad., Cassiar Mts., B. C.; Coll. A. J. Stone. ⅛ nat. size.

Of the six specimens of *R. montanus* collected by Mr. Stone in the Cassiar Mountains, four are adult males, one is an adult female, and the other a yearling female. The female and three of the males agree very closely in coloration; the other male, apparently the oldest of the series, is much paler colored throughout. The young female differs from the adults as already stated (p. 5).

This form of Caribou differs markedly in color from the Woodland Caribou, which it most resembles, in being very much darker

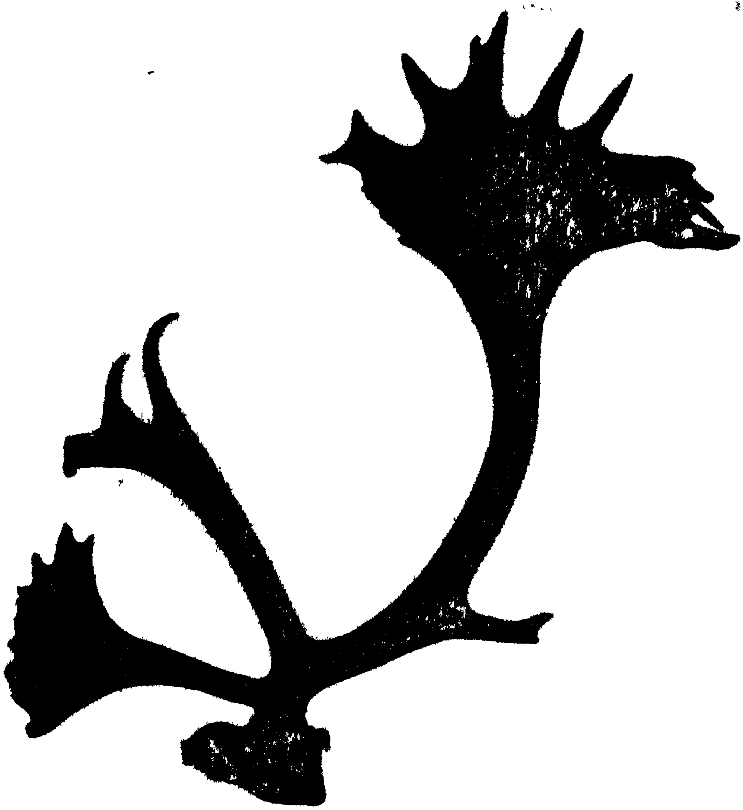

Fig. 6. *Rangifer montanus*, ♂ ad., Ho-tai-luh Mts., Cassiar District, B. C. Antlers unusually developed. Coll. A. J. Stone. ⅛ nat. size.

throughout, in its larger size, longer and heavier antlers, and in the large size of the white rump patch, which is practically obsolete in the other forms of the genus, or, at least in the lighter forms, very indistinctly defined. This patch, measured across the base of the tail, has a breadth of 250 mm., but is divided through the middle by the dark band, 50 mm. wide, that passes down the tail, the white patch being thus separated into two areas, each with a transverse width of 100 mm.

The most remote ally of *R. montanus* is *R. terrænovæ*, not only geographically but in coloration and structural characters. *R. montanus* has the facial portion of the skull elongated and slender, in contrast with the short, thick skull of *R. terrænovæ*. In *R. montanus* the antlers are very long, yet heavy and massive in comparison with those of *R. grœnlandicus*; in *R. terrænovæ* the antlers are still more massive, but much shorter than in *R. montanus*. The differences in the skull and antlers of these three forms are well shown in the accompanying illustrations.

Unfortunately there is lack of material for satisfactory comparison of the different forms of this genus. While the Museum has mounted specimens of *R. caribou*, *R. terrænovæ*, *R. grœnlandicus*, and *R. montanus*, and additional skins and skulls of most of them, the skulls are in few cases comparable, being either more or less imperfect or very unlike in age. For the use of a fine series of adult male skulls of the Newfoundland Caribou, from which the accompanying photographs were taken, I am indebted to Mr. A. C. Humbert of this city; unfortunately these heads were mounted before I was able to measure them. The female skull of the Newfoundland Caribou here figured (kindly loaned to me by Mr. J. Rowley) has unusually large antlers for a female, and in this respect is not quite normal.

Doubtless when series of specimens of Caribou from different parts of Alaska, including the tundra district west of the Mackenzie Delta, and from different parts of the Northwest Territory, are brought together, it will be found that the Caribous of the region north of the United States are differentiated into quite a number of well-marked local forms as yet undescribed. This is the opinion of Mr. Stone, who has observed them at various different points, and has obtained much information respecting their distribution, as set forth in his paper on the large mammals of the

Fig. 7 (upper figure). *Rangifer terrænovæ*, ♂ ad., Humber River, Newfoundland. Coll. A. C. Humbert. [illegible] nat. size.

Fig. 8 (lower figure). *Rangifer terrænovæ*, ♂ ad., Humber River Newfoundland. Coll. A. C. Humbert. [illegible] nat. size.

North (*postea*, Article V). The present form, *R. montanus*, appears to inhabit about the same section of country as the dark form of the Mountain Sheep (*Ovis stonei*), and, as regards coloration, is a parallel form.

As a contribution toward a better knowledge of our Caribou I present herewith a series of illustrations of the skulls of three

Fig. 9. *Rangifer terrænovæ*, ♂ ad., Humber River, Newfoundland. Coll. A. C. Humbert. ⅛ nat. size.

of the forms, namely, *Rangifer montanus*, *R. grœnlandicus*, and *R. terrænovæ*, all photographed to the same scale, by my assistant Mr. John Rowley, Chief of the Department of Taxidermy. The series of *R. montanus* includes four adult males and an adult female, and an additional pair of weathered antlers. The series of *R. terrænovæ* includes three adult males and an adult female,

Fig. 10 (left upper figure). *Rangifer grœnlandicus*, ♀ ad., No. 14236, North Greenland; Lieut. R. E. Peary. ⅛ nat. size.

Fig. 11 (right upper figure). *Rangifer montanus*, ♀ ad., No. 15716, Cassiar Mts., B. C.; A. J. Stone. ⅛ nat. size.

Fig. 12 (lower figure). *Rangifer terrænovæ*, ♀ ad., Newfoundland. Coll. F. D. Pelton. ⅛ nat. size.

the latter with exceptionally large antlers. Photographs of only two examples of *R. grœnlandicus* are given, an adult male and an adult female, but both are typical, well developed specimens, as shown by the Museum series of this species.

Beginning with *R. grœnlandicus*, the specimen shown in Figure

Fig. 13 (left figure). *Rangifer grœnlandicus*, ♂ ad., No. 11097, Holsteinborg, Greenland; Prof. L. L. Dyche. ¼ nat. size. From same specimen as Fig. 1.

Fig. 14 (right figure). *Rangifer grœnlandicus*, ♀ ad., No. 14236, North Greenland; Lieut. R. E. Peary. ¼ nat. size. From same specimen as Fig. 10.

1 is strictly comparable with the specimen of *R. montanus* shown in Fig. 2. While the general form of the antlers is the same in both, they are much thicker in the beam, and heavier in the palmated parts in *R. montanus*. The skull is also much larger and heavier, and quite different in the frontal outline.

In Figures 3, 4, and 5 are shown other examples of antler in

Fig. 15 (left figure). *Rangifer montanus*, ♂ ad., No. 15714, Cassiar Mts., B. C.; A. J. Stone. ⅛ nat. size. From same specimen as Fig. 2.

Fig. 16 (right figure). *Rangifer montanus*, ♀ ad., No. 15716, Cassiar Mts., B. C.; A. J. Stone. ⅛ nat. size. From same specimen as Fig. 11.

Fig. 17 (right figure). *Rangifer terrænovæ*, ♂ ad., Humber River, Newfoundland. Coll. A. C. Humbert. ⅛ nat. size. From same specimen as Fig. 7.

Fig. 18 (left figure). *Rangifer terrænovæ*, ♀ ad., Humber River, Newfoundland. Coll. F. D. Pelton. ⅛ nat. size. From same specimen as Fig. 12.

R. montanus. All are from practically adult males, but the smaller and lighter forms doubtless represent younger animals than the one shown in Fig. 2.

The antler presented in Figure 6 represents doubtless an unusually heavy development of antlers in *R. montanus*. The pair was found by Mr. A. J. Stone, in 1896, in the Ho-tai-luh Mountains, a western spur of the Cassiar Mountains, in northern British Columbia, and hence within the range of *R. montanus*; this pair was saved by Mr. Stone on account of its unusual size and form.

Figures 7 to 10 represent variations in the antlers of *R. terrænovæ*. Fig. 7 may perhaps be taken as typical, and as strictly comparable with Fig. 1, *R. grœnlandicus*, and Fig. 2, *R. montanus*. In the heavy palmation and relative shortness of beam, *R. terrænovæ* is strikingly different from the other two forms, and the skull is relatively short and heavy. I have previously given a figure of the male antlers of this species (this Bulletin, VIII, pl. x), which shows the heavy branching of the antlers characteristic of this species.

Figures 10 to 12 illustrate the skulls of females of the same species. Fig. 10 represents the skull of an adult female of *R. grœnlandicus*. Fig. 11 shows an average female skull of *R. montanus*—the only one thus far examined, but it is apparently an average, normal example. Fig. 12 represents a skull of *R. terrænovæ*, with unusually large antlers, but otherwise normal. A more normal antler of the female of *R. terrænovæ* has previously been figured in this Bulletin (Vol. VIII, pl. xi, Fig. 2).

As a further contribution to this subject I add views of the ventral aspect of the skull of both male and female of the same three species. All were photographed by Mr. Rowley to a uniform scale, so as to make them strictly comparable. The scale is larger, however, than in the series of figures (Figs. 1–12) of the antlers already given.

Figure 13 represents an adult male of *R. grœnlandicus*, and Fig. 14 a female of the same species.

Figures 15 and 16 give corresponding figures of male and female skulls of *R. montanus*. The striking difference in size is at once noticeable, as is also the greater facial elongation of the skull in *R. montanus* as compared with *R. grœnlandicus*.

Figures 17 and 18 show male and female skulls of *R. terrænovæ*. Compared with the skulls of *R. montanus*, the latter are obviously longer and broader, and differ in details of conformation. The great size of *R. terrænovæ* as compared with *R. grœnlandicus* is too evident to call for comment. There are also obvious differences between the two latter species in respect to various details of proportion and structure.

The following notes on *Rangifer montanus*, as observed in life, are from a letter from the collector, Mr. A. J. Stone, dated Fort Simpson, N. W. T., June 30, 1898.

"These large and beautiful animals," he says, "range through almost the same kind of country as that occupied by the Mountain Sheep [*Ovis stonei*]. They traverse the very high muskeg valleys that separate the mountain ridges, while the sheep generally pass around them. They range in the mountains wherever the sheep do, with the exception of the most rugged paths shut in by steep rocky cliffs. They rarely visit the timber, and when they do, remain there for only a short time. During severe storms in winter they sometimes wander into the edge of timber, but do not seem to find there the food they desire. Their favorite winter feeding ground is the top of high, bold mountain ridges, which they frequently cross by well beaten paths through the high passes, but seldom descend to low ground. In winter they will paw through the snow for food, but usually seek feeding grounds from which the snow has been blown by the winds.

"The rutting season I find to be almost identical with that of the Moose, or from the last of September to the last of October; the calves are dropped in May. They do not seem to be as prolific as the Moose, only one calf being produced at a birth. The calves grow with great rapidity, far outstripping the growth of our domestic animals, but they do not acquire flesh as rapidly as the domesticated calf. I also find that the breeding season is somewhat irregular. I saw in September two calves that appeared to differ two months in their ages.

"The velvet is shed from the antlers in the males about the first of September, the old males shedding first, and the younger ones later, according to age and condition. The females shed the velvet about a month later than the males, the barren females shedding first, and those with calves and the younger animals later.

"In spring and summer these animals follow the snow line well into the mountains, and here their habits are much like those of the Mountain Sheep. The old males seek the more secluded retreats, where they remain in quiet and rapidly take on flesh. The females remain behind where the elevated tablelands are of greater extent, and are the first to work their way back, in September, to the bald ridges already mentioned, where they are joined by the males. In September and October they may be seen crossing the muskegs from one mountain ridge to another.

"Their fastest gait is a trot, and they are rarely seen to leap, and then for only two or three jumps. Their motion is peculiar, and very unlike that of the Moose. They stand very erect on the legs when trotting, and move in such a way as to give the appearance of great rigidity to their limbs. Their movements are not graceful, nor yet clumsy, reminding one of a pack horse, trotting under a heavy load; they do not travel as rapidly as the Moose. When trotting they carry the head several inches lower than the back, and straight in front, the nose slightly elevated, and the antlers erect, giving the effect of extreme rigidity. If they wish to look to the right or left they almost invariably stop and turn the entire body in a direct line with head and neck.

"I had no means of weighing any of these animals, but by carefully estimating the meat that came from a large male, and allowing for the gross weight, I was led to conclude that its live weight was about 700 pounds. I believe that full grown males in the fall, when fat, will weigh from 550 to 750 pounds, and that the females will range in weight from 400 to 550 pounds.

"The Indians are very fond of the contents of the stomach that has not yet received its second mastication]; they mix it with the blood of the animal and boil all together into a kind of pudding."

EXPLANATION OF PLATE I.

Fig. 1. *Receptaculites pearyi* Whitf., p. 19.

" 2. *Heliolites perelegans* Whitf., p. 21; also showing a vertical section of *R. pearyi* on the top.

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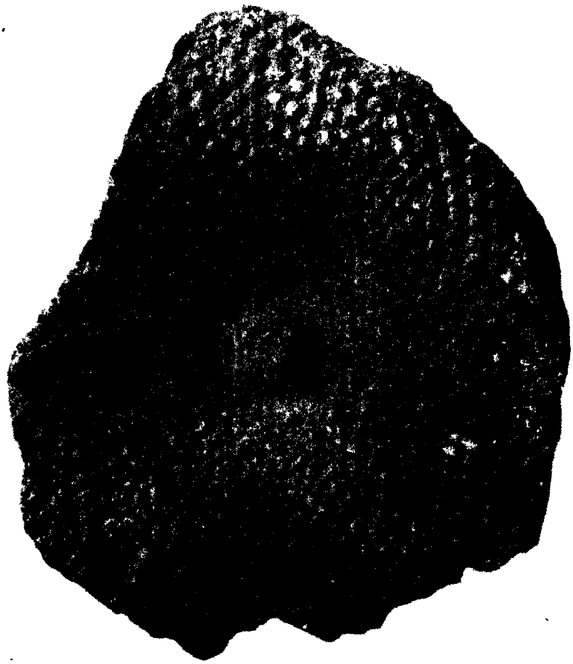
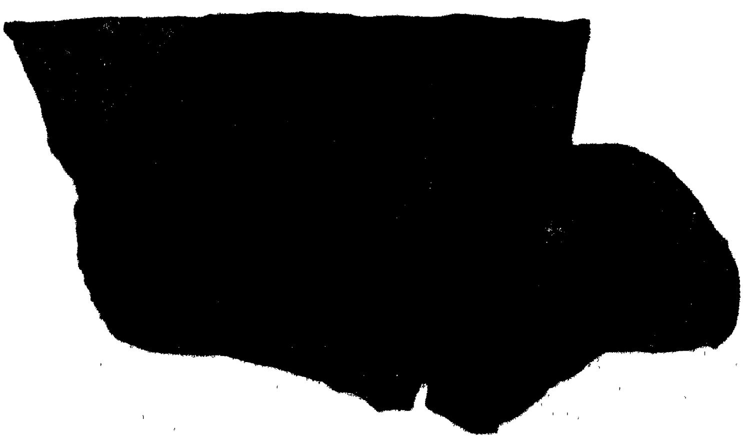




ARCTIC FOSSILS.

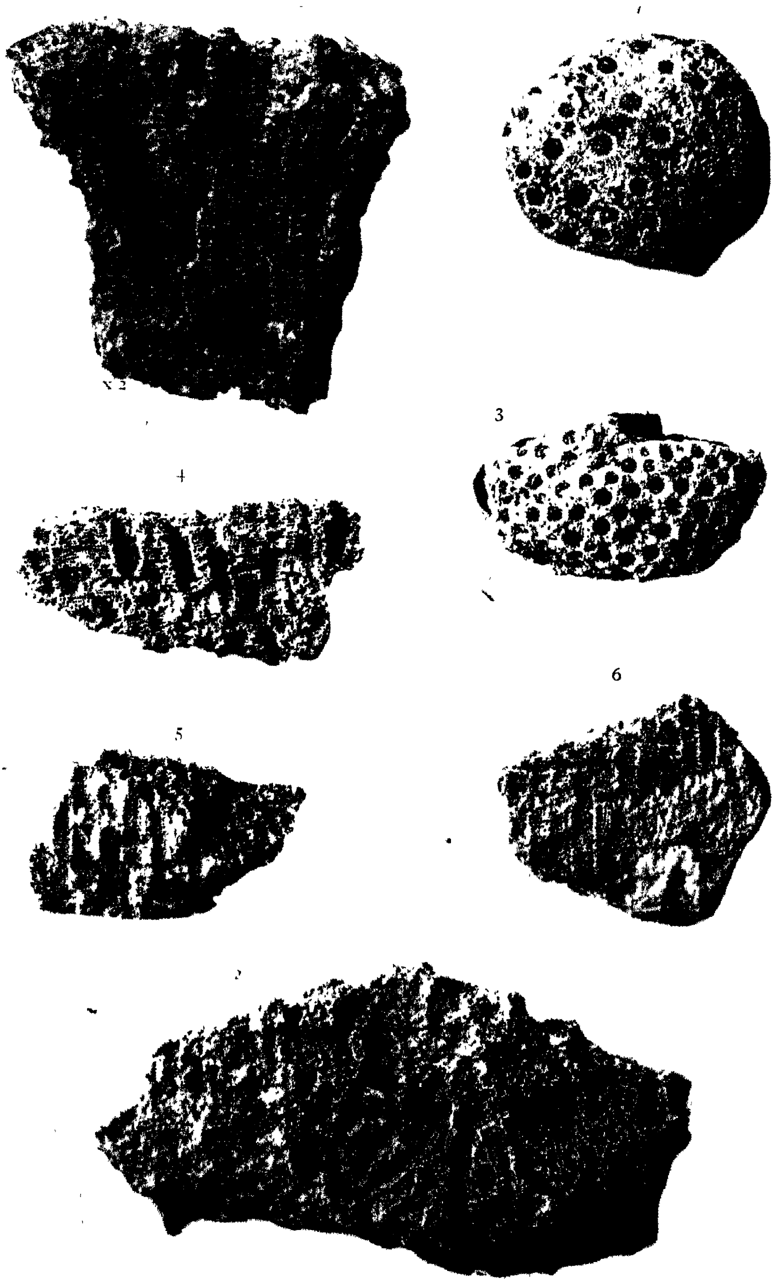
EXPLANATION OF PLATE II.

Halysites agglomeratiformis Whitf., p. 20.

Fig. 1. Enlargement to 2 diameters of a vertical section showing the tabulæ.
" 2. View, natural size, of the under surface.

Colopæcia borealis Whitf., p. 20.

Fig. 3. View of the top of a small colony.
" 4. Vertical section of a weathered fragment with thick intercellular spaces.
" 5. Section having no intercellular substance, but numerous mural pores.
" 6. Vertical section showing mural pores
" 7. Top view of a small, convex colony with excessive intercellular



Arctic Fossils.

Article II.—OBSERVATIONS ON AND DESCRIPTIONS OF ARCTIC FOSSILS.

By R. P. WHITFIELD.

PLATES I AND II.

A few fossils, sent to the Museum by the Peary Arctic Club of New York, were collected by the Peary Expedition of 1898, at Cape Harrison, on Princess Marie Bay, and Summit, Cape d'Urville, in the arctic regions.

The latter specimen bears indications of fossil plants, and what may have been a *Helicotoma* or *Ophileta*, and reminds one of similar appearing things from the Calciferous formation of Lake Champlain. The specimen is evidently of float material, and consequently of little or no value geologically.

The remainder of the material consists of corals, partially silicified, in limestone, and one very good example of a *Receptaculites*, resembling *R. oweni* Hall from the lead-bearing beds of Illinois, Wisconsin, and Iowa. Among the corals, there is a representative of *Halysites agglomeratus* H., differing specifically; also a *Heliolites*, related to *H. pyriformis;* a new species of *Calapœcia* and a *Stromatopora*, probably *S. concentrica*. These specimens would indicate a geological horizon about the same as that of the New York Niagara or Clinton Group.

Some of the species are specifically distinct from their representatives in New York, and are described below under new names, with photographic figures of them on Plates I and II.

Receptaculites pearyi, n. sp.

Form explanate and undulating, resembling *R. oweni* Hall, of the western lead-bearing rocks, Galena Limestone. Cells proportionally large, and diverging concentrically, as is usual in the genus; at a distance from the central point of origin, they will measure nearly or quite 3 mm. in diameter; on the upper surface they are low-pyramidal and distinctly stellate under a hand glass. Disk near the centre thin, but at the distance mentioned above, the thickness will reach 16 to 19 mm. (five-eighths to three-fourths of an inch).

The specimen is from limestone and is entirely calcareous, the filling of the cells being crystalline. The principal specific feature is its large cells, and even close to the point of origin this is distinctly noticeable.

They are from the east side of the entrance of Cope Bay, Princess Marie Bay, Sept. 4, 1898.

Halysites agglomeratiformis, n. sp.

This species closely resembles *H. agglomeratus* of the New York Niagara Limestone, except that the cells are somewhat smaller, less closely compacted, having open meshes more like *H. catenopora* L., but not so large. The cell walls are very thin and fragile, the tabulæ in the tubes very closely arranged and flat, differing in this last feature from those of *H. agglomeratus*, which are generally quite deeply concave.

The examples of this species are from Cape Harrison, Princess Marie Bay, Sept. 4, 1898, and are somewhat silicified in a limestone matrix.

Calapœcia borealis, n. sp.

This is undoubtedly the *Clisiophyllum*, sp., of Salter, described in the appendix to Sutherland's 'Voyage to Baffin's Bay,' Vol. II, p. ccxxxi; and figured on Plate VI; Fig. 7. It is not a *Clisiophyllum*, not having a central axis; and it is not a *Favistella*, as the walls are densely perforated, and the tabulæ entire and complete. It seems to agree in all its features with *Calapœcia* Billings (=*Columnopora* of A. Nicholson), but differs from *C. crebriformis*, in either having larger cells or, when small, possessing an intercellular vesicular substance, in which case it closely resembles a *Heliolites*, and may readily be mistaken for *Heliolites macrostylus* Hall, which is most probably only a species of *Calapœcia*, and not a true *Heliolites*. As it is only known from an impression, or natural mould of the upper surface, its true generic relations are uncertain, the coral itself being as yet unknown. In this species, the cell openings vary from 3 to 4 mm. in diameter, and in most examples seen, the cells are divided only by thin walls, but in some of the examples the cells are separated by from 1 to 5 mm. of vesicular intercellular material. The cell walls, when seen on weathered specimens, have from three to five vertical rows of mural pores, which are more nearly quadrangular than round, and present much the appearance of an open textile substance. Tabulæ very closely arranged, three to five in a space equal to the diameter of the cell. Colony hemispherical, but those seen are mostly fragmentary.

The examples are from Cape Harrison, Princess Marie Bay, Sept. 4, 1898.

Heliolites perelegans, n. sp.

Corallum hemispherical in outline, with cells from one to one and a half mm. in diameter on the surface of the colony, with an intercellular substance of from one-half to sometimes more than two-thirds the diameter of the cell in thickness, and having from one to four vesicles in its thickness, as shown on longitudinal sections. Tabulæ very numerous and closely arranged, from four to seven occurring in a space equal to the diameter of the cell; occasionally incomplete, but rarely so; slightly convex upward or flat. No mural pores are present.

Differs from *Heliolites spinopora* Hall, in having complete tabulæ. From *H. elegans* of the same author it differs in its larger, more distant cells, and in its hemispherical instead of explanate form of growth. From *H. pyriformis* Hall, its nearest analogue, it differs in the less compact arrangement of the cells, and in the absence of longitudinal ray-like ridges projecting upon the tabulæ, which so distinctly mark the separated tube casts of that species.

Cape Harrison, Princess Marie Bay, in limestone, with *Receptaculites pearyi*, Sept. 4, 1898.

During the season of 1896 a few fossils were sent to Prof. Franz Boas by G. Cromer, Esq., of Boston, who obtained them from Eskimo who collected them near the head of Frobisher Bay.

The following species are represented:

Small *Zaphrentis* or *Streptelasma*, sp. ?	4	Specimens
Orthis (Dalmanella) testudinaria Dalm. sp.	1	"
Orthis (Plectorthis) jamesi Hall	1	"
Cyclospira bisulcata Emmons, sp.	2	"
Strophomena planumbona Hall	1	"
Cyclospira, undescribed sp., plicated	2	"
Rhynchonella increbescens Hall, not *R. capax* Conrad	4	"
Tellinomya alta Hall	1	"
Murchisonia (Lophospira) tricarinata Hall, sp. = *M. milleri* Hall	2	"
Helicotoma planulata, or an undescribed sp.		Fragment
Bellerophon, sp. undisc., nearest to *B. lindsleyi* Safford	4	Specimens
Onçoceras plebium Hall	2	Fragments
Trochoceras, sp. undetermined	1	"
Trocholites, sp. undetermined	1	"

The geological horizon indicated by this group of specimens

would be lower Trenton. The specimens are from calcareous clay and are finely weathered, indicating a locality where fine collections of fossils might be obtained with little trouble. The specimens have been collected from the surface and are mostly of small size and imperfect, so much so that those representing undescribed forms are too poor for description and illustration, though sufficient to determine the geological position.

NEW CRINOID.

THE HELIOTYPE PRINTING CO., BOSTON.

EXPLANATION OF PLATE III.

Actinocrinus semimultiramosus Whitf. The figure is from a photograph and is natural size. The stem of the upright specimen is continuous to the margin of the stone, passing under the edge of the recumbent specimen.

Article III.—DESCRIPTION OF A NEW CRINOID FROM INDIANA.

By R. P. Whitfield.

Plate III.

Actinocrinus semimultiramosus, n. sp.

Two individuals of the same species and of large size, but of somewhat different stages of thickening and development of the surface ornamentation of the plates of the calyx, occur in close approximation on a block of limestone. They are of the type of *Actinocrinus lowei* Hall, as published in his Iowa report, and also very similar to *A. multiramosus* W. & S., being more closely related to this than to *A. lowei.* There appear to be only three bifurcations of the ray on each primary division, as is the case in *A. multiramosus*, and only one of the arms from each side of the ray appears to bifurcate subsequently, while in that species a much larger number divide. The arm plates are of about the same size and closely resemble those of that species.

The plates of the body, in one individual, are marked by a transverse node with ridges passing from it to the adjoining plates. On the other specimen these nodes and ridges are only partially developed and the plates are much less thickened, but this is a feature only of age of the individual. The plates of the arms are in double series interlocking on the back, and on the inner ends bearing pinnulæ.

The pinnulæ are spine-bearing on the lower part of the arms to the third and fourth joint, decreasing upwards to one on the first joint only, and finally to none whatever.

The plates of the dome are not seen on either specimen, and both seem entirely destitute of a summit proboscis or tube.

Column round, large, the plates strongly alternating in size, and rounded on the edges for a considerable distance below the base of the cup, becoming more even in size as they recede from the cup, but still alternating in thickness with rounded edges, to a distance of six inches below the cup. All the plates of the

stem show strong but fine vertical crenulations on the edges. Canal small.

This species differs from *A. multiramosus* W. & S., which is the nearest allied species, in having fewer bifurcations ; in being destitute of a central tube, and strongly in the form and character of the column or stem.

Formation and Locality.—In the Keokuk or Knob Limestone, four miles south of Salem, Indiana, on the New Albany road. In the collection of the American Museum of Natural History, New York City.

EXPLANATION OF PLATE IV.

Mosasaurus maximus Cope.

Fig. 1. View of the two jaws, slightly from above, and one-third natural size.

Fig. 2. Inside view, natural size, of two of the teeth and the intermediate socket of another. Below the teeth the partially developed or successional teeth are seen at *a*, *a*.

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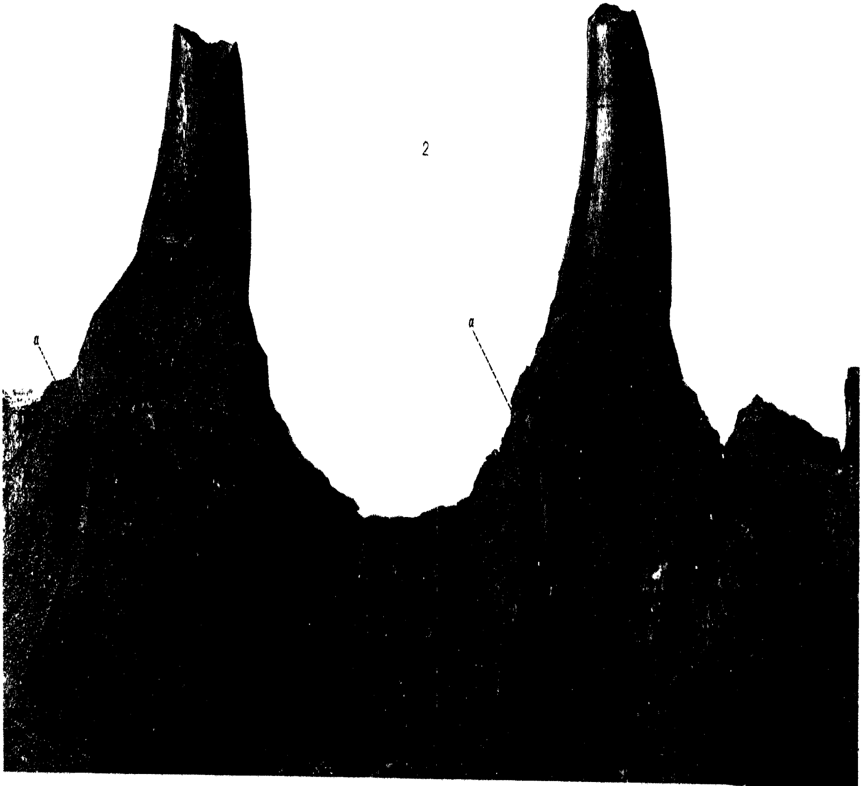

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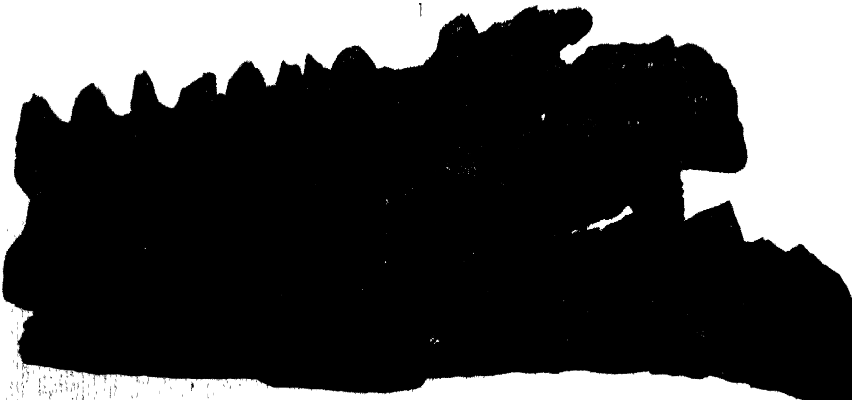


MOSASAURUS MAXIMUS, *Cope.*

MOSASAURUS MAXIMUS, *Cope*.

THE HELIOTYPE PRINTING CO., BOSTON.

EXPLANATION OF PLATE V.

Mosasaurus maximus Cope.

Fig. 1. View of the right coronoid bone from the inside with a fragment of the articular bone below it, one-half natural size.

Fig. 2. View of the same bone from the outside, on the same scale as Fig. 1.

Fig. 3. View of the right coronoid bone of the Mosasauroid Reptile, *Tylosaurus proriger* Cope, on the same scale as the above for comparison.

Article IV.—NOTE ON THE PRINCIPAL TYPE SPECIMEN OF MOSASAURUS MAXIMUS COPE, WITH ILLUSTRATIONS.

By R. P. Whitfield.

Plates IV and V.

In the 'Transactions' of the American Philosophical Society for 1871, new series, page 189, Prof. E. D. Cope described and published *Mosasaurus maximus*, basing it on specimens found in New Jersey. The most important of these was from the farm of Geo. W. Crawford, at a place called Nut Swamp, and at the time in the possession of Dr. G. J. Fisher, then in Sing Sing, N. Y. In 1892 the American Museum of Natural History obtained this specimen with a number of vertebræ from Dr. Fisher, and the specimen was brought to the Museum and the fragments placed together in their true relations. In doing this, it was found that instead of being a single ramus of a lower jaw as had been supposed, it really consisted of parts of both lower rami extending back to the articulation of the rami, each side having eleven teeth or sockets, some of which are in fair condition of preservation. In Prof. Cope's description he intimates that there were twenty more or less perfect teeth. When the parts of the specimen were put together it was found that there were eleven teeth or tooth sockets on each ramus, and that several of them contained the successional teeth at the base of the present teeth or in the sockets.

The following is taken from Prof. Cope's description and remarks[1] on this extraordinary specimen :

"The remains of a still more gigantic individual of this species were submitted to me by Dr. G. J. Fisher, of Sing Sing, New York, in whose possession they now are.

"The bones were obtained through the efforts of P. R. Brinckerhoff, of Westchester County, N. Y., in the latter part of the month of April, 1860. They were found on the farm of Geo. W.

[1] 'Synopsis of the Extinct Batrachia, Reptilia and Aves of North America.' By Edward D. Cope. Trans. Am. Phil. Soc., XIV, N. S., 1871, pp. 1-252, pll. 1-14 *a*. The extract is from pp. 190-192.

Crawford, at a place called Nut Swamp, three miles south of Middletown, Monmouth County, N. J. They were first discovered on opening a ditch through a meadow in Nut Swamp; G. W. Crawford, being an intelligent farmer, took immediate measures to prevent their disturbance or injury, by having them protected until he could inform P. R. Brinckerhoff.

"Accordingly, on the last week of April, P. R. Brinckerhoff succeeded in obtaining from this locality the portions of bones described.

"They were all found at a depth of about four feet below the surface, and within an area of a few square feet. The bones were imbedded in wet marl, which contained an abundance of most of the fossils peculiar to the formation, as Gryphæa, Exogyra, Terebratula, Belemnites, etc. Near this spot, about fifteen years ago, considerable portions of bones, but more particularly the vertebræ of the Mosasaurus, were found by J. M Smith and Lyell Conover.

"The portions found were so detached and diffused, as to afford no hope of obtaining much more of the skeleton without very extensive and expensive excavations, and it was with extreme difficulty that P. R. Brinckerhoff, by the aid of one or two men, and by one-and-a-half days' labor, succeeded in procuring the present specimens. There was a constant influx of water into the trenches, and the bones were very fragile.

"The bones obtained, consist of large portions of the inferior maxillaries, with twenty, more or less, perfect specimens of full-grown teeth, and several successional teeth,—with a posterior dorsal vertebra.

"Drawings were made directly from the specimens.

"The largest fragment found is a portion of the left inferior maxilla. It measures twenty and three-fourths inches in length; at the broadest extremity it is about seven inches deep, at the small extremity it is five inches; the upper or alveolar portion of the jaw is generally about three and one-quarter inches thick; the lower margin is quite uniformly two inches thick. This mass was considerably fractured in removing it from its bed, as is seen in the plate.

"It contains the roots of three teeth, two of which have most of their enamelled crowns attached. The space between the first and second tooth is three inches. The space between the second and third teeth is two and three-fourths inches.

"The roots of all the teeth are somewhat compressed laterally; the longest diameter of the root of the first tooth is two inches; of the second, two and one-fourth; of the third, two inches.

"The lateral plates in the dentary bone come in contact a few inches behind the first tooth.

"In another fragment of the jaw, containing five or six teeth, we find the roots placed in actual contact throughout; and

knowing the law of their arrangement, we can readily estimate the length of the jaw.

"The combined length of all of the fragments collected of the lower jaw, measures four feet, and includes fourteen teeth, which is the full number said to belong to each side in M. giganteus. The series completed would no doubt contain eighteen teeth. As the coronoid and angular processes and the distal extremity are not included in the above measurements, it would be safe to calculate the lower jaw of this specimen to have been six feet and a half long. The cranium measured nearly the same, and would indicate a larger animal than any Mosasaurus yet discovered.

"The greater portion of the coronoid element of the left inferior maxilla, is nine inches in length; in the broadest part it measures four and three-fourths inches in width. The border is concave and regularly rounded. This border is quite uniformly two inches thick, while the remaining portion of the fragment is thinner. Another portion of the left lower jaw contains the roots of three teeth placed in contiguity. The crowns or apices of the teeth have been broken away. This fragment is seven inches long, four and one-quarter inches deep, and three and one-quarter thick.

"Three large foramina are seen on the external surface, which communicate with the dental canal.

"This portion of the jaw is well preserved, and like all the fragments found, is entirely black, and extremely heavy; the high specific gravity, as well as the color, is due to their impregnation with iron; the pulp cavities of the teeth, as well as the concentric laminæ of the apices, are incrusted with deposit of exceedingly minute crystals of iron pyrites. In other portions of the bones a deposit of vivianite is occasionally seen.

"In the teeth belonging to this species of Mosasaurus, the root is large, the lower extremity inclining backwards; it contains a minute cavity, being nearly solid, and apparently composed of simple osseous tissue. The apex or crown of the tooth arises from a somewhat conical base, which corresponds with the margin of the alveolar cavity; it tapers rapidly to a point; the teeth are recurved and divided into two faces, one looking forwards and outwards, the other presenting backward and inward; the dividing line between the anterior and posterior faces is very distinct, consisting of a sharp unserrated or simple cutting edge. These acute edges or carinæ separate faces, of which the posterior is more convex. The crowns of these teeth were measured by Dr. Fisher, as follows:

	Inches.		*Inches.*
First, anterior face..........	1 4-8	posterior........	1 7-8
Second, " "	1 3-8	"	2
Third, " "	1 2-8	"	2 2-8

"The pulp cavity extends about as far into the root as the crown, excepting its entrant foramen in the former.

"The mode of succession of the teeth is well seen in this specimen, and illustrates the process as indicated by Leidy (Cretac. Rept., p. 51). The fang-like basis of the functional tooth undergoes extensive excavation by absorption to furnish space for its successor, the remaining portion in some places being reduced almost to a shell, yet remaining firmly adherent to the alveolar walls, without the slightest evidence of displacement. This and other specimens examined, prove that the old tooth is not removed till the process of absorption has extended to the alveolar margin, when the crown is easily detached.

"The splenial bones present the usual remarkable character. At the posterior extremity of each, the articulating cavity is narrow ovoid in form, subacuminate below, and not so broadly rounded as in the M. dekayi.

	Inches.
Long diameter	3.25
Transverse	1.75
Total depth of splenial at extremity	4.5
Of rounded face below dentary plate	2.25

"The surface appears to be adapted for motion in two directions.

"The vertebra which accompanied the jaw measures as follows:

	Inches.
Length centrum	4.7
Width anterior articular face	4.55
Depth " " "	4.65

"It is a dorsal with diapophyses below the middle; between it and the neural arch, near the articular extremities, the surface is marked with sub-longitudinal rugæ.

"This Mosasaur could not have been less than eighty feet in length."

On both parts of the specimen there are new teeth showing on the inner posterior side of the old teeth. These are of different sizes and ages, as if there were no special rule as to the age at which new teeth replaced the old ones, and the base of the older one is excavated or absorbed around the young tooth, leaving a large open space.

Views of the jaws are given on the plates, also of two of the teeth showing the new teeth at the bases. The figures are all from

photographs. Prof. Cope speaks, in the article cited, of "drawings" of the specimen. But none is given on any of the plates in his article, hence the necessity of this notice and accompanying illustrations.

The coronoid bone mentioned on p. 191 is also in possession of the Museum. It measures, as Prof. Cope says, nine inches in length by four and a half in width. The figure of this bone is reduced to one-half the natural size, and a view given on the same scale of the corresponding bone from a specimen of the Mosasauroid *Tylosaurus proriger* Cope, from the Niobrara chalk beds of western Kansas.

Prof. Cope appears to have considered this bone as the left coronoid, but on close examination and comparison with that of other species, it proves to be a right instead of a left.

From the lower marl bed of the Upper Cretaceous, from three miles south of Middletown, Monmouth County, New Jersey.

Article V.—SOME RESULTS OF A NATURAL HISTORY JOURNEY TO NORTHERN BRITISH COLUMBIA, ALASKA, AND THE NORTHWEST TERRITORY, IN THE INTEREST OF THE AMERICAN MUSEUM OF NATURAL HISTORY.

By A. J. Stone.

[Introductory Note.—Mr. A. J. Stone, in planning the journey, of which the following pages give some of the principal geographical and zoölogical results, visited the American Museum of Natural History in the hope of securing aid from the Museum authorities in carrying on his work. Upon careful consideration of Mr. Stone's itinerary, and of the results he hoped to attain, the enterprise was promoted by pecuniary aid generously furnished, in the interest of the American Museum, by Mr. James M. Constable. As shown by the itinerary set forth below, the journey was an arduous one, and as planned involved extended travel through country that could be traversed only by dog teams, or by means of improvised boats, thus precluding the transportation of bulky collections. Mr. Stone procured, however, on portions of his trip, valuable collections, some of which have been made the subject of papers in this Bulletin (Vol. IX, 1897, pp. 111–114; Vol. XII, 1899, pp. 1–9; Vol. XIII, 1900, pp. 1–18), and some are still on the way to the Museum. In addition to collecting specimens, where means of transportation rendered it feasible, Mr. Stone has gathered in his note books a large amount of new information regarding not only the geography of the region traversed, and the Eskimo and Indian tribes inhabiting it, but also respecting the distribution and habits of the larger game animals met with in different parts of his route. This information seems of sufficient importance to warrant permanent record, and is here presented as a part of the results of Mr. Stone's expedition. In preparing his rather voluminous notes for publication Mr. Stone has allowed me discretionary power to select, condense, and arrange the matter as seems to me most fitting. I am also responsible for the technical names of mammals given in the following notes.—J. A. Allen.]

Introduction.

I was impelled to undertake the explorations here imperfectly detailed by the belief that the natural history of the northern parts of North America, from about the fifty-second parallel of latitude northward, had been as yet very imperfectly explored, and that the field was therefore an inviting one for research and discovery. Furthermore, the dearth of specimens of the larger mammals in

our museums, and the fact that some of them are becoming rapidly extirpated, seemed an additional reason why their collection in series, for exhibition and study, should be entered upon without further delay. While knowing that the undertaking involved hardship and danger, and a considerable outlay of money, it seemed to me that the results of a protracted and well conducted expedition would far more than warrant the risk incurred. If successfully accomplished, the journey would furnish not only much-needed material for scientific research, but yield much valuable information regarding the variety and distribution of animal life in these forbidding regions.

The trip as originally planned involved three years of travel, through regions devoid of all regular means of transportation, and to a large extent uninhabited, except by scattered native tribes, and in large part thus far only superficially explored. Aware that my own limited means was quite inadequate for such an enterprise, I naturally sought to connect myself with some public institution, and felt myself fortunate in securing an alliance with the American Museum of Natural History, through the liberality of the First Vice-President, Mr. James M. Constable. While I successfully accomplished the itinerary as laid out for the first two years, I failed, in consequence of numerous unforeseen difficulties in the way of securing food and proper means of transportation, in securing some of the animals I unfortunately made it my special quest to obtain. On reaching the Mackenzie Delta, and also at some other points on the long inland journeys, it was exceedingly difficult to secure either the necessary assistance from the natives, or a proper outfit of dogs for sledding purposes. Again it was impossible to rely upon the information obtained in respect to the nature of the country, or the haunts of the larger game animals, especially the ranges of the Musk-ox along the Arctic coast east of the Mackenzie River.

ITINERARY.

My work began in 1896, when I made a trip, by way of Fort Wrangel, to the headwaters of the Stickine River, in northern British Columbia, the central point of my field of exploration being latitude 58° N. and longitude 130° W. The principal scientific result of this journey was the discovery of the Mountain

Sheep, described by Dr. Allen in this Bulletin (Vol. IX, 1897, p. 111) as *Ovis stonei*, the series of specimens on which it was based being now the property of this Museum. This trip proved very satisfactory as preliminary work, and prepared me for the difficulties of the more extended journey I then had in view.

The following year I left Seattle, Washington, for Fort Wrangel, Alaska, July 9, 1897. From Fort Wrangel I ascended the Stickine River to the head of navigation, at Telegraph Creek. From Telegraph Creek I made an expedition into the Cheonnee Mountains, returning to Telegraph Creek the latter part of August. I then crossed the divide to the head of Dease Lake, a distance of 75 miles, at which point I left my baggage and made an extended trip through a great wilderness of country into the Cassiar Mountains, penetrating the mountains to a distance of about 100 miles from the lake and bringing out on our backs specimens collected about 60 miles from the head of the lake.

I descended Dease Lake in an open boat to where it empties into the Dease River, and followed down the Dease River to the Liard, thence down the Liard to a point where, for one hundred and twenty miles further, it could not be considered navigable on account of dangerous rapids and waterfalls.

It was the 20th of October, when we reached this point on the Liard, at the mouth of Black River, a large stream, which here joins the Liard. The ice was already rapidly forming on both streams, and preparations were made for winter. In December, I ascended the Black River to Walker Mountains, a distance of about one hundred miles. After the holidays we transported by dog-sled all our equipage down the river on the ice, a distance of one hundred and twenty miles, to a point below Hell Gate Cañon, where boating in the spring might be resumed. The work was one of very great labor and extreme difficulty, but was accomplished, and the second long portage overcome.

When I reached my cache in April not one of the three white men who were to help in boat-building was available. Indian help from the people upstream I knew could not be had, and, harassed by a lot of murderous renegades, collected near my cache with the hope of looting it, I was a prisoner in the great wilderness for over thirty days, when the ice went out of the river, and the large canvas boat I had constructed all alone,

proved its capability of floating a ton of stuff, which I managed without help among fields of heavy ice, snags, and rapids, until I reached Fort Liard, a Hudson Bay trading post, one hundred and fifty miles below my point of departure.

At Fort Liard I secured help, and descended the river another one hundred miles, where I left it for a trip into the Nahanna Mountains.

During the latter journey I traced the exact northern limits of the range of *Ovis stonei* and the southern limits of the range of *Ovis dalli*.

On my return I continued down the Liard River, reaching Fort Simpson, on the Mackenzie, the middle of June, 1898.

Descending the Mackenzie I stopped at Fort Norman, a Hudson Bay trading post, from which place I took a party of Indians and travelled into the main range of the Rocky Mountains to the neighborhood of where the Arctic Circle crosses them, at which place I spent considerable time. I travelled many miles of that part of the Rockies, and sent from there the most perfect series of specimens of *Ovis dalli* ever taken for any natural history institution.

Returning to Fort Norman I continued down the Mackenzie, to the head of the delta, reaching there about the 10th to 12th of October, just as the ice had closed over the Peel River, which flows into the Mackenzie at this point. I reached Fort McPherson, the most northerly of the Hudson Bay Company's trading posts, in lat. 67°30′, thirty miles by dog-sled, travelling on the river ice.

From Fort McPherson I made a trip in October to the west with dog-sleds, crossing the Rockies, and returning again to Fort McPherson, after a month spent in a fruitless hunt for Caribou. On reaching their range we found they had moved too far southward to be overtaken, owing to our scanty supply of provisions, and the worn-out condition of the dog teams.

In November I traversed the Mackenzie Delta, and the Arctic coast westward for 250 miles, as far as Herschel Island, returning in December. This 500-mile sled trip enabled me to learn something of the country in that direction, and of the natives and larger mammals inhabiting it. The intense cold of an Arctic winter, however, precluded the preparation of specimens.

Anthropometric measurements were taken of quite a number of the Noonitagmioots at Herschel Island. During the entire journey not the fluttering of a bird, the hoot of an owl, or the cry of a wolf could be heard. We were completely enveloped in the pervading stillness of Arctic night.

The months of March, April, May, and June, 1898, were employed in a thousand mile sled trip to the east, along the Arctic coast to beyond Cape Lyon, in search of Musk-oxen, which, from information obtained at Herschel Island, I was led to expect would be easily found, with also a reasonable prospect of being able to ship home the specimens by whaling ships from Cape Bathurst. A half-day's travel southwest from Darnley Bay we discovered our first sign of Musk-ox, but they were not very fresh. We then penetrated the rugged country to the south and east of Cape Lyon, day after day, until the food for men and dogs became completely exhausted; our efforts being rewarded by no greater success than the locating of 'signs' of these animals, none of which was very recent. I came to the conclusion that they had wintered in the region we had reached, but that, driven by storms, scarcity of food, or by a natural desire to wander, they had migrated to other pastures, probably moving southward. I returned to Langton Bay to reprovision the sled for a further journey in pursuit of them. But the day we reached Langton Bay, my companion, Mr. Corbusier, was taken so completely snow-blind that he had to be drawn upon the sled, and my Indian assistant became seriously ill with what afterward proved to be scurvy. My own eyes soon gave out, so that for eleven days I was compelled to live in darkness. We were nearly a thousand miles from Fort McPherson, and the ice was already beginning to soften; we thus had to weigh the alternative of returning at once, and as rapidly as possible, to Mackenzie Bay, or of remaining where we were until another winter should make a roadway of ice again. Although the temptation to remain was strong, we left Langton Bay at 8 P.M., on May 11, and reached Fort McPherson June 16, sledding as far as McKinley Bay, when the ice broke up, compelling us to complete our journey in a boat I was fortunate enough to secure, with the services of its Eskimo owner, at this point. This trip of six hundred and fifty miles and return, though devoid of results in the way of specimens,

was fruitful in other ways, giving me a personal knowledge of a portion of country even geographically imperfectly known.

In July I crossed the Rockies and descended the Bell River to the Porcupine, and then down the Porcupine to the Yukon, reaching the Yukon on the 14th of August. I continued down the Yukon to St. Michaels, and thence by ocean steamer to Seattle, Washington, which place I reached just twenty-six months and four days from the time of starting.

During this entire period of travel I availed myself of every possible source of information bearing on the distribution of animal life throughout the regions traversed, and the information thus gathered I have attempted to summarize in the following notes.

While the naturalist seems to have acknowledged the country to be too large or too difficult to explore, the prospector for minerals and the adventurous fur trader have camped throughout its extent.

The fur trader, working along the streams, with his following of natives, has driven the animals well away from the streams into the mountains, as they had previously been driven back from the vicinity of the coast, and now the prospector is aiding the Indian in their final extermination in the mountains.

The Bison of the plains are gone; the few living Wapiti have been driven to the high mountains; the Pronghorn Antelope and the Rocky Mountain Bighorn are almost creatures of the past; and the large game animals of the extreme North will soon meet the same fate.

I found evidence that a species of Caribou which existed plentifully twenty-five years ago in the country west of the Mackenzie and between the Yukon and Arctic coast, is now most likely extinct.

It is not simply the number of animals killed by the rifle that depletes their ranks; this same disturbing element has a wonderful influence in repressing their reproduction.

There are sections of country in the North and Northwest that still abound in mammal life, but their former general distribution has been very much disturbed, there being large areas capable of supporting them in abundance over which the larger mammals are almost entirely absent.

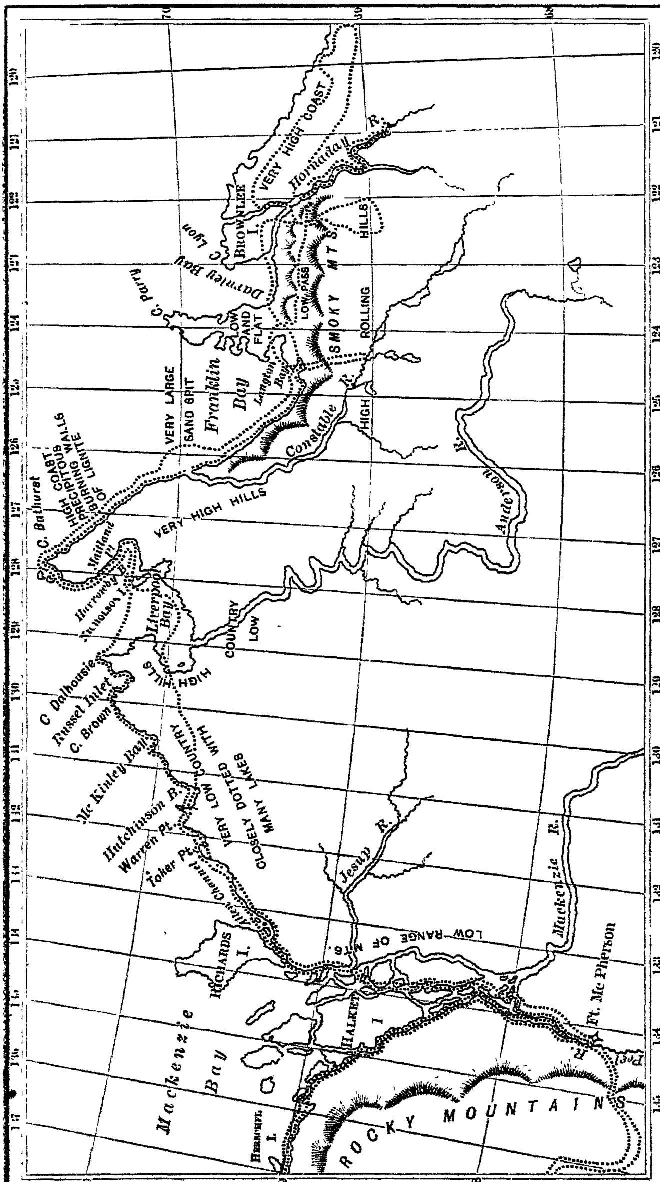


Fig. 1. Sketch Map indicating Geographical Corrections and Observations; also showing a portion of Mr. Stone's Arctic Coast Journey. (The dotted lines indicate Mr. Stone's route.)

GEOGRAPHICAL NOTES.

My journey along the Arctic coast east of the Mackenzie River enables me to make some corrections in the accepted charts of this section of the coast. I found, for example, that certain charted lakes and rivers have no real existence, and that other important topographic features have been overlooked. To these latter I have given names, and indicate their location by means of the accompanying sketch map (see Fig. 1).

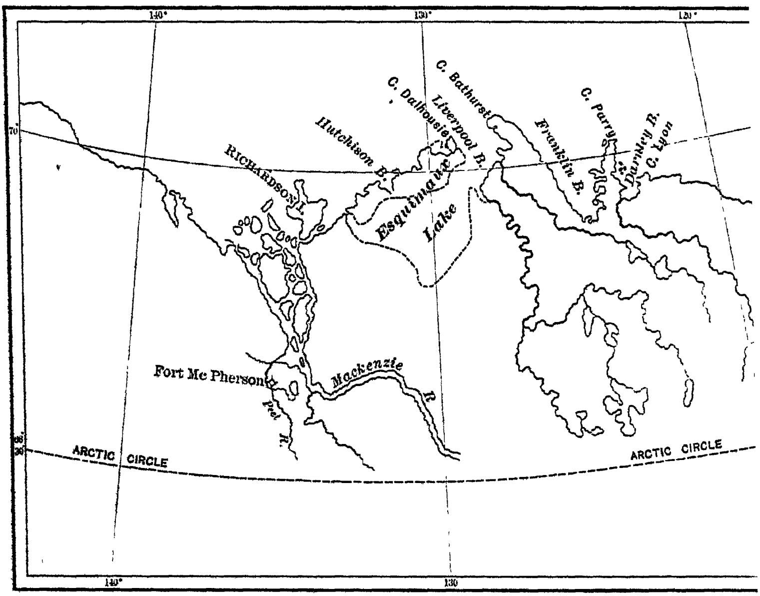


Fig. 2. Sketch Map showing position of Esquimaux Lake as indicated on the U. S. Hydrographic Chart No, 1189. The Rivers are from Rand & McNally's Map of North America.

Thus "Esquimaux Lake," as indicated on the U. S. Hydrographic Chart No. 1189, corrected to date of issue, April 10, 1898, has no existence, this area being in reality low level country interspersed with lakes, some of them of considerable size, connected by narrow channels, and thus forming a continuous chain. Esquimaux Lake, as charted (see Fig. 2), is subtriangular in outline, with an east and west diameter of about 200 miles, and a north and south diameter of about the same extent. I

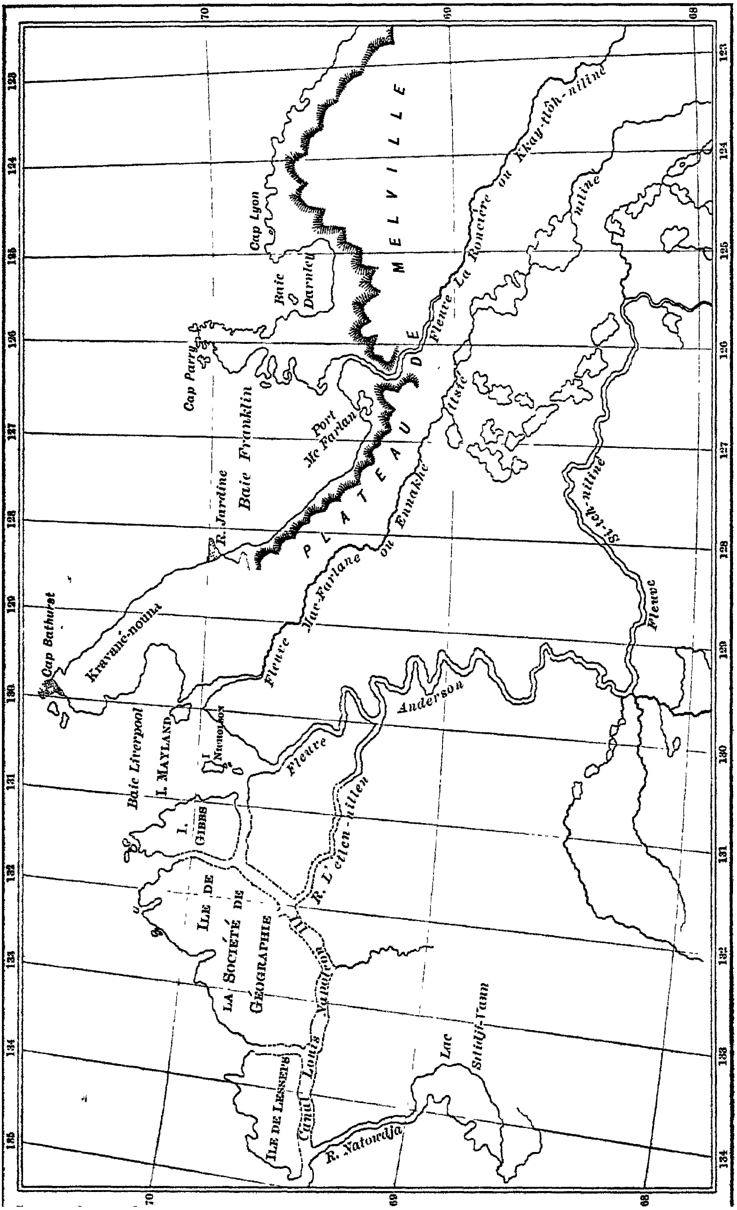


Fig. 3. Transcript of portion of Emil Petitot's Chart. (See pages 38 and 40.)

have crossed this area twice with dog-sleds and found it to be land and not water.

Nicholson Island, of this same chart, is wrongly located. It should be the unnamed island just off Maitland Point (see Fig. 1). It is really a peninsula most of the time, it being connected with the mainland by a sand spit which is not always covered by water.

I had with me the "Carte des Explorations de l'Abbé Émile Petitot, dans les deserts du Grand Lac des Ours," published in 1875 "par la Société de Géographie." This map having been accepted as authoritative, and as I have been over considerable portions of the country charted by Petitot, it may not be out of place for me to point out some of its errors. In brief: (1) his "Canal Louis Napoleon III," located to the east of Liverpool Bay, does not exist; nor are there any such islands as his "Ile de Lesseps," "Ile de la Société de Géographie," and "Ile Gibbs," but instead one continuous stretch of land terminating with Cape Dalhousie.

There is also no such river as Petitot's "Fleuve MacFarlane ou Ennakhi," flowing into Liverpool Bay; and Anderson River does not empty into Liverpool Bay at the point designated by Petitot, but pours its waters into the extreme southwest portion of the Bay. His "Fleuve la Roucière ou Kkay-tlôh-nilinè" also does not exist, nor does any river flow into Franklin Bay as this is represented to do.

Having twice covered this entire stretch of coast country with sleds, I am persuaded that the extensive observations of Émile Petitot were largely based on the representations of the natives, which I find quite as unreliable in matters geographical as they are in all other matters relating to size, length, breadth, and distance.

There is a river of considerable size emptying into Franklin Bay about midway its western shore (see Fig. 1), that I have named Constable River, in honor of Mr. James M. Constable, Vice-President of the American Museum.

A large stream that flows into the Mackenzie Delta from the east, breaking through a low range of mountains which runs north and south parallel with the East Branch of the Mackenzie Delta, I have named Jesup River, in honor of Hon. Morris K. Jesup of New York City.

The beautiful channel separating Richards Island from the mainland, fully 75 miles in length, I have named Allen Channel, in honor of Dr. J. A. Allen, of the American Museum of Natural History.

A river of considerable volume emptying into southeast Darnley Bay, that I followed as a sled route for a considerable distance, I have named Hornaday River, in honor of William T. Hornaday, Director of the New York Zoölogical Society.

An island to the west of Darnley Bay, at the mouth of Hornaday River, I have named Brownlee Island, through respect for the Hon. Judge W. H. Brownlee, of Missouri, a friend of my boyhood.

Notes on Mammals.

The following notes, based on my field observations, relate to some of the larger mammals of the northern districts of North America. I have supplemented my own experience by information derived from various officers of the Hudson Bay Company, and from intelligent white and Indian hunters.

Bison bison athabascæ *Rhoads.* Wood Bison.—The Bison, generally spoken of as Wood Bison, is almost extinct. The most reliable information obtainable indicates that a small herd, containing fifteen to twenty animals, exists in the Hay River country, Long. 117° W. and Lat. 59° N., a little to the west of Great Slave River. I was repeatedly informed that there was a similar herd to the east of Great Slave River, a little further north than the Hay River herd, but I have some doubt of its existence.

The furthest north to which I could trace these animals is the Black River country, where a solitary old bull was killed some years ago, a short distance south of Fort Liard, about Long. 130° W. and Lat. 60° N.

The Canadian Government is making an effort to protect the few that remain, but it will doubtless be ineffective, it being impossible to police these remote regions against the inroads of the Indians, who kill the Bisons at every opportunity. I very much question whether the small remnant now existing will be able to hold out against existing conditions for more than a few years.

Probably three years will accomplish their complete extermination.

I visited Fort Liard with the intention of securing specimens for the American Museum of Natural History, but found that to attempt it might involve me in unpleasant legal proceedings and possibly lead to serious difficulties in the further prosecution of my work.

Ovibos moschatus *Blainville.* MUSK-OX. — I found no trace of these animals anywhere, except in the very hilly, rough country, southeast of Cape Lyon. Nearly all the signs of them I found indicated that their favorite feeding ground in winter is along the slopes of hills just a little above the valleys, where they browse freely on the little patches of dwarf willows. It was also quite evident that when moving from one feeding ground to another they almost invariably travel single file.

Their range is becoming more and more contracted all the time, as roving bands of Indians from the Hudson Bay posts, on Great Slave Lake and near Great Bear Lake, make occasional raids upon them, and almost always destroy the entire herd attacked.

The result of extensive inquiry among the Indians and Eskimo west of the Mackenzie leads me to believe that the Musk-ox has not inhabited that region for a very long period. Indeed, only a few of the Kookpugmioots east of the Mackenzie have any knowledge of their ever having been seen west of Anderson River, or anywhere between that river and the Mackenzie. Their western limit is now far to the east of Anderson River and Liverpool Bay.

Ovis stonei *Allen.* STONE'S MOUNTAIN SHEEP; BLACK SHEEP. — The range of *Ovis stonei* extends throughout the Cassiar Mountains, and in the Rocky Mountains, east of the Cassiar, north to where Beaver River, a tributary of Liard River from the north and west, breaks through the Rockies near latitude 60°. I believe that the Rocky Mountain divide, between the headwaters of the Peace River and those of the Fraser River, forms the dividing line between its range and that of the southern *Ovis cervina.* Its western limit very nearly conforms to the Cassiar Mountains and their numerous spurs.

The feeding grounds of both *Ovis stonei* and *O. dalli* are above timber line. Their habits vary materially, in both species, with sex and age, especially in summer. Old and young, however, congregate together in the fall and winter. During winter they frequent the highest ridges, where the wind keeps the ground free of snow.

Ovis dalli *Nelson*. DALL'S MOUNTAIN SHEEP; WHITE SHEEP.—This beautiful inhabitant of boreal America occupies two separate and distinct ranges, namely: (1) the Alaskan Mountains and the Kenai Peninsula; and (2) the entire stretch of the Rocky Mountains north of latitude 60°, to near the Arctic coast west of the Mackenzie, ranging thence west to the headwaters of the Noatak and Kowak Rivers, that flow into Kotzebue Sound.

Along the Arctic coast they are subject to the same persecution as the Caribou of this region (as detailed below), and will in a few years be only a memory of the past. Further south, through that portion of their range included in the Rockies, their future is only slightly more hopeful. In the Nahanna Mountains (a spur of the Rockies, in about 60° N. Lat.), and in the main Rockies about Lat. 69° N., the natives reported them as very much scarcer than formerly, and the old trails, in the country travelled by me, indicated that a much larger number of these animals formerly existed there.

I found these animals everywhere above the timber line and almost always occupying the most rugged parts of the mountains, the males particularly favoring the most rugged and rocky ridges.

Five out of twenty-two specimens shot by me tumbled over precipitous walls into inaccessible places and were lost. One of the lost five was found in a bunch of three resting on a ledge, seemingly not over a foot wide, on the face of a cliff fully 2000 feet high, from base to summit. They were not over 150 feet from the crest of the summit, over which I leaned and watched them, unobserved, for some time. How they reached the place or left it I could not tell. I had one of my Indians drive them out by throwing stones down, and as I heard them running below I followed along the brink. When they finally appeared

at the top I was a considerable distance from them. I fired at the first two to appear and failed to score, but being a little nearer when the third one came in sight my bullet caught him fair; he gave two leaps to the right, fell and toppled over the brink and went down for a hundred yards. We could descend part of the distance to where he lay but there was a space beyond so steep and high that it was impossible to pass over it even with ropes; yet it was just here that the sheep had climbed up.

This was my first effort on this hunting ground, and the result was just a little discouraging, inasmuch as my party had not tasted food during the past thirty hours. I was myself tired and hungry, for during this thirty hours I had carried a pack across the mountains some ten miles, and had been on the tramp climbing and hunting for sheep all the rest of that time, with the exception of about three hours, it being so light that we could hunt, night or day; but there was nothing to do but try again.

Slowly working our way around the point over sharp rocks in our moccasined feet, with thoughts of another day without food uppermost in my mind, I was almost startled by three big rams running out from a clump of rocks, only a short distance ahead of us, and passing so quickly out of sight around another clump as to prevent my getting another shot. It never occurred to me that I was tired, footsore, or hungry, for I was after those rams, jumping from rock to rock as fast as my legs could carry me. After following them for some distance I got in a long-range shot, shooting down a very steep incline, and was delighted to see one of the big fellows go down among the rocks; the other two being further away, and offering very poor marks, I did not pursue them. It was a difficult task to descend this steep and treacherous slide to take care of this specimen, but we gladly went about it, and finally climbed back to the top, through a rain that was wetting the rocks and making them slippery. Camp was a long way off, but there was fuel there, and we had steaks to go with the fuel, which smoothed the road considerably.

As this animal has been but little observed by naturalists or hunters, I will relate one other adventure, as illustrating its wonderful vitality, agility, and endurance. One of my Indians came in one night and reported having crippled a large ram which he failed to get. The next morning I decided we would hunt in

that direction, in the hope of securing the cripple, as I have the utmost horror of leaving a crippled animal of any kind to die a lingering death. Reaching the level top of a high ridge, we skirted it for a short distance and then separated into two parties. I took with me the Indian who claimed to have crippled the ram the day before ; in reality, however, I did not believe his report. After following along the edge of a deep cañon for about a mile, he proposed that I should watch from above, while he descended to look for the cripple. He had been gone for some time, and was out of sight, when I heard him halloo ; on running along the crest for some distance I finally discovered him making his way up the bottom of the cañon, calling every few steps. I could not at first make out what he was up to, but soon a sheep made its appearance from behind a jutting point, and a little later it was plainly to be seen, creeping along over the rocks ahead of the Indian, up the rugged cañon, seemingly with difficulty. I concluded the Indian could easily get in range and kill the poor beast, and I could not at first understand why he did not do so, but I soon came to the conclusion that he had discovered that the easiest way of getting that skin and bones to the top of the long, hard climb was to drive the animal ahead of him, knowing that I was at the top and would be on the lookout.

As I proceeded to the head of the cañon, in order to be ready to dispatch the beast on its arrival, I could see that one hind leg was broken, and as I watched the poor thing jump from one crag to another as it mounted that long, steep climb, I felt disgusted with such proceedings and would have gladly carried up the skin rather than see the animal suffer, had I been in a position to do so. While I was thinking what this animal must have suffered during the preceding twelve hours, of how exhausted it must be from such a climb on three legs, and wondering if it would really get to the top, to my surprise it suddenly stood on the crest of the cañon wall, seventy-five or a hundred yards distant, fully fifteen minutes sooner than I thought possible.

As it turned toward me and caught sight of me I raised my rifle and fired. It fell, turning completely over ; then it jumped up and was away across the ridge like a shot, its broken leg swinging like a pendulum at every jump. As soon as I recovered from my surprise, I followed as fast as I could run, only to see it

disappear over the side of the next cañon; it circled the side of the cañon wall and took a stand on a jutting ledge of rock, upon which, if I shot it, it would topple off down on to the rocks, several hundred feet below, and be ruined as a specimen; so I sat down to await its possible change of position. After a short while my white man and natives arrived, and two of them decided to go around and chase him down. As they approached him, down he went, apparently as lively as ever, and another chase took place, lasting until the white man was played out.

From the edge of the cañon I could watch every move; twice the native tried his smooth-bore without effect, and I began to think the ram would get away from him. It climbed a deep cut between two high turrets in the side of the cañon wall nearest me and found its way into a deep cavity in the side of one of the great natural abutments and lay down. The Indian could not get to the place, but threw stones at the poor beast until it ran out. As it left this big cavity it either had to leap directly down fifteen or twenty feet or pass out by the Indian; and here was just where it displayed its wonderful capabilities in a most daring manner. As it emerged from the cavity it crept along the wall, which to all appearances was almost perpendicular, and continued straight on for twenty-five or thirty feet. It then turned around and came back to the edge of the cavity and leaped down, falling as it struck the rock below; but it was immediately up and away, seemingly as game as ever. The Indian, who was within a few feet of the animal at the time, said that he could not see anything in the shape of a projection on the face of the rock for the animal to walk on, nor could any of us do so at a distance of perhaps two hundred yards with the aid of powerful field-glasses.

I stood carefully watching every movement of the animal, and how it was possible for it not only to walk the side of such a wall, crippled as it was, but actually to turn round and walk back, is beyond my conception, for I am sure there was no place on the face of the wall to which I could have clung for even a moment.

The Indian again went in pursuit, finishing the animal soon after with a lucky shot. I went down to measure and skin the animal, but found the greater part of its coat so thoroughly filled with blood, much of which had dried and set fast, that I only saved the head.

The shot the Indian first gave it had completely smashed the left thigh. My shot had entered the left side just back of the shoulders and a little above the heart, ranging backward and upward, and passing out at the right flank, tearing a fearful gash, through which I could thrust my fist. It had bled much, internally and externally; had lived nearly twenty-four hours after its thigh was smashed; four hours after the wound I gave it, suffering from the loss of blood, making wonderful climbs on three legs, and performing feats hardly to be believed even by those who witnessed them. The animal was a four-year old ram, and a magnificent specimen.

From my experience with these animals I believe they seek quite as rugged country in which to make their homes as does the Rocky Mountain Goat. They brave higher latitudes, and live in regions in every way more barren and forbidding.

Although they are a very wary animal where hunted, they are rapidly dwindling in numbers, for their white bodies in summer can be seen at a great distance by the keen eye of the native, and very few of our best natural history collections will be graced by their beautiful forms before the last of them have disappeared.

The females, with their lambs, generally keep to the high tablelands, well back in the mountains, and are often much more difficult to locate than their mates. Broken jawbones, reunited, were so frequent among the females killed as to excite comment.

Oreamnos montanus (*Ord*). ROCKY MOUNTAIN GOAT. — The Rocky Mountain Goat is found in limited numbers throughout the Rocky Mountain Range as far north as latitude 63° or 64° 30′, but are here nowhere so plentiful as in the coast ranges. They frequent many places in the Cascades, the Coast Range of southeastern Alaska, and the Alaskan Mountains as far west as the headwaters of the Sushitna River.

Alce americanus *Jardine*. MOOSE. — The Moose is the best known of the Deer that inhabit the vast extent of country comprising British Columbia, the Northwest Territory, and Alaska. It can be safely asserted that every wooded section of this immense area is, to a more or less degree, frequented by these animals. It ranges westward almost to the limits of the

Alaskan Peninsula, and it approaches the Arctic coast throughout to the very limits of tree growth.

The Upper Liard River, with its tributaries, the Dease, Francis, Highland, Black, and Coal Rivers (longitude 125° to 130° west, and latitude 58° to 60°), includes, perhaps, the most prolific Moose range in America. The tributaries of the Upper Yukon, Pelly, Stewart, Macmillan, White, and Tananna Rivers, also drain a country well populated with Moose, and the Kenai Peninsula and the region about the head of Cook Inlet is another large area that seems to abound with them.

The native and the wolf are its most aggressive enemies ; but it is highly probable that it will outlive the former, regardless of the fact that modern firearms may be found in the possession of members of almost every native tribe in the North.

The Moose, in the regions within the Arctic Circle, will be the last to succumb to its enemies, for the reason that in this great interior country, it will be but little pursued east of the Rockies by the white man. The atmosphere in this country is comparatively dry in winter and the snowfall consequently light, and owing to the shelter from the winds afforded to a great extent by brush and woods, the snow does not crust or acquire a firm enough surface to admit of a wolf running on the surface, except on lakes and rivers ; and without this aid the wolf can make but slight inroads upon the numbers of an animal so wary and cunning, of such wonderful endurance, and so capable of self-defence.

It is also well known that these animals, in the North and Northwest, do not gather together in herds, nor do they 'yard up,' as do the Moose of Maine and New Brunswick, but constantly roam about, either singly or in small bunches, rarely exceeding five individuals. The natives cannot, therefore, locate and surround them in bands, but must pursue them singly, which forbids at all times any considerable slaughter. Then, too, this animal generally haunts the very worst thickets, tangles, and brushy localities ; its hearing is acute, its scent the best, its movements rapid, and it is so universally on its guard that the unusual snapping of a twig is sufficient to cause it so quickly and silently to quit the locality as to be totally unobserved by the average hunter. I have passed through sections of country

where whole tribes of natives have become extinct, but the Moose lives and flourishes in numbers, the rugged country drained by the Nahanni River being an instance of this kind. The headwaters of the Stickine River, occupied by the Tahltan tribe, may also be cited as another fair illustration. The tribe is so rapidly dying out as to be perceptibly less in numbers every year ; while the Moose is far more plentiful in that country to-day than it was at the time when modern firearms wer first introduced among these people twenty-five years ago.

Records of the Hudson Bay Company at Fort Norman, 65° N., give the weight of a dressed animal, with hide, head, and lower limbs removed, at 676 pounds, and Fort McPherson (67° 30′ N.) records claim that the meat of an animal received at this post weighed between 1100 and 1200 pounds.

The Indians' claim that the Moose of the headwaters of the Koyukuk River and of the headwaters of the Peel River range high in the mountains, and differ in some respects from the animals inhabiting lower levels, but I was unable to verify such statements through personal observations. Mr. Hodgson, for many years in the service of the Hudson Bay Company in that country, assured me that this was known to him to be a fact, stating they were often killed high in the mountains, that their feet were very different from those of other Moose, and that they differed in other particulars. As the Moose of the Kenai Peninsula are now considered to be a distinct form [*Alce gigas* Miller] from those of eastern Canada, it is most probable that the animals referred to as inhabiting the mountains of the headwaters of the Peel River, and those of the Koyukuk and Colville further north, will prove to be a third variety.

The Moose of British Columbia and southeastern Alaska do not inhabit the Pacific slope of the Coast Range Mountains, but west of the Copper River, Alaska, they range in many places to the neighborhood of salt water.

Rangifer, *Genus.* THE CARIBOUS.— It is to me a matter of deep regret that I cannot see in the future of the North the same bright prospects for the continued existence of the Caribou that there is for the Moose, for the Caribou, the grandest of all northern land animals, is doomed. It is so constituted as to render

it incapable of so well eluding its pursuers and surviving its enemies as the Moose. For years it has supplied the natives of the North with more food than has the Moose, and in addition clothes the greater portion of the population.

The Caribou found north of latitude 56° are as yet very imperfectly known. I have traversed long stretches of country in the endeavor to learn something more of them, but the question now seems to me a greater problem than ever before. The country occupied by them is so large, the distances are so great, and the means of travel are so inadequate that the task of properly tracing the distribution and relationships of these animals is a gigantic one.

These animals range throughout the mainland of North America from about latitude 48° to the most northerly limits of the continent at Boothia, in latitude 72°, and they are found from the eastern border of Labrador west, through one hundred and ten degrees of longitude to the extreme point of the Alaskan Peninsula; they inhabit the woodlands, the vast barren plains, and the most desolate rock-bestrewn mountain tops. Vast droves of them [the Barren Ground Caribou, *Rangifer arcticus* (Rich.)] leave the Arctic coast in the fall and travel south toward the timber, returning to the coast in the spring. This same migration occurs in the region to the west of the Mackenzie as well as in the region east of that river, and yet the herds of these two regions never intermingle or come in contact with each other in any way. Notwithstanding this regular migration to and from the coast every year, as winter comes and goes, vast numbers never leave the coast during any part of the year. It has become clearly evident to me that the animals composing one of these herds are larger than those of the other herd; they also occupy areas widely separated, with little if any opportunity for commingling, while other conditions tend to the development of distinct forms. I therefore feel safe in saying, after my limited personal observations, that the Caribou are the least known of any of the more important North American mammals; and that they present a most inviting field for study, with excellent possibilities of ample reward for the labor expended; and I may further add that the time for their investigation is limited. To successfully prosecute such a work would necessitate the ex-

penditure of a considerable sum of money, and require a vast amount of pluck, perseverance, and patience, and entail on the part of the explorer the endurance of much privation and hardship.

On one of the charts accompanying this report [not here reproduced] are represented various sections of the country in the North most prolific in Caribou life. Each of these large areas should be visited for the purpose of studying in life the different varieties of Caribou inhabiting them, and numerous specimens, with complete and careful measurements, should be secured in order to furnish the zoölogist with the means of properly investigating these interesting animals.

The mighty Mackenzie seems to form, throughout its entire length, a well-defined dividing line between eastern and western herds ; in fact, we find that at most points this dividing line is a broad belt of country, in places more than one hundred miles wide. The herds that reach the coast in the spring, to the west and east of the Mackenzie Delta, never approach each other nearer than seventy-five miles, and rarely so near as this.

West of the Mackenzie vast numbers have been slaughtered to provide the whalers wintering at Herschel Island with fresh meat. The natives, who are often the regular hunters sent from the ships, shoot them, consume the head, shoulders, and ribs, and cache the saddles until thirty to fifty of them have been accumulated, when the ships' sleds go out and draw them in.

The inhabitants of Herschel Island informed me that the saddles procured there from the mainland generally weighed about thirty-three pounds per saddle, while those coming from Richards Island or Kittygagzyooit, to the east of the Mackenzie, average considerably heavier. In the mountains east of the Mackenzie, both south and north of Bear River and Great Bear Lake, there is a large kind of Caribou which I believe to be different from any of the others here mentioned. A large form is also to be found in the Rockies west of the Mackenzie, which ranges north well into the headwaters of the Peel River.

Again, to the north of the Porcupine, and in the regions of the headwaters of the Koyukuk, Noatak, Kowak, and Colville Rivers, we also hear of large Caribou.

The large Mountain Caribou [*Rangifer montanus* Seton-

Thompson] taken by me in the Cassiar Mountains, September, 1897, I believe to range throughout the Cassiar range and to occupy a considerable territory in the Rockies to the east of the Cassiar Mountains, and it extends for a considerable distance both to the north and south of the latitude in which my specimens were taken. I am very sceptical as to the species having ever extended south to within the borders of the United States. A quite large Caribou inhabits the timbered slopes to the south of the Liard River, down through the Peace, Athabasca, and Saskatchewan districts, and in all probability this is the animal occasionally taken in northern Montana and Idaho.

The species of which I forwarded specimens to the American Museum of Natural History, in the fall of 1897, occupy a habitat almost identical with that of *Ovis stonei*. They range high in the mountains, winter and summer, are very rarely found in timber, and feed but little in the cañons, even above timber line. Several adult specimens were taken and very carefully measured, these measurements indicating great uniformity in size.

Hudson Bay traders who once occupied posts at old Fort Yukon and at the Ramparts on the Porcupine tell me that there was at one time a red Caribou in the mountains north of these places, and numerous Loucheux Indians gave me the same information, but they had not seen any of them for several years, and did not believe that any were to be found there now. If, however, they ever existed it is highly probable that some yet remain in the region of the headwaters of the rivers mentioned above, as it is a game region little disturbed by natives and never molested by white men.

The color of a very young Moose calf is that known in horses as a deep bay; at a very early age a line of dark hair makes its appearance along the top of the neck and, continuing along the back, terminates with the end of the tail; this rapidly becomes very prominent until the young Moose assumes very much the appearance of young mules, which are often marked in the same manner. As the calf begins to assume its winter coat, this stripe gradually loses its prominence, the entire coat becoming dark.

Caribou calves are lighter in color, the shading of red is not so even over the body, being lighter on the lower flanks and on the belly and legs, and it lacks the dark dorsal stripe of the

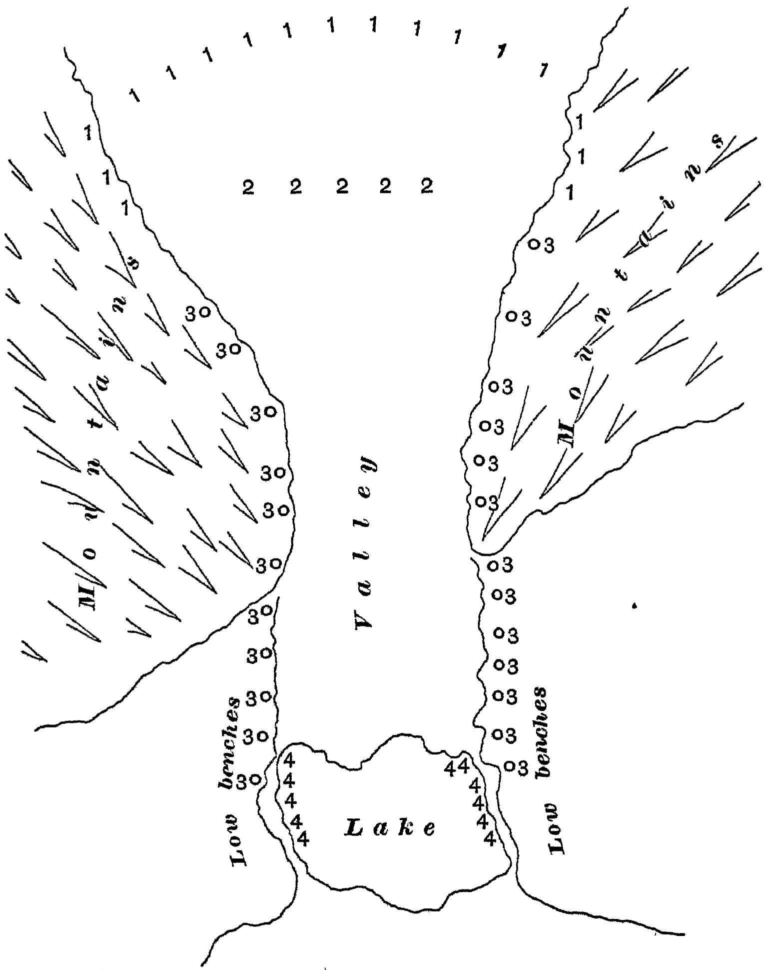
Moose calf. Caribou and Moose calves are both small when first born, the Moose calf being especially small in proportion to the size of its parents, but the calves of both grow very rapidly, far more rapidly than a domestic calf, in proportion to the size of the matured animals.

I believe the antlers of the Caribou are rather untrustworthy in determining species, but I am confident that the average antler of the larger species is heavier than the average antler of the smaller species. I have seen numerous heads of antlers of the Barren Ground Caribou that were very long, but they are always light and delicate in proportion to their length, and never have the weight or strength of antlers of the larger Caribou of the same length. I have in my possession a pair of antlers from a large inland Caribou that I believe will weigh twice as much as the largest pair of Barren Ground Caribou antlers ever found. (See *antea*, p. 8, Fig. 6.)

The 12th day of May, while skirting the west shore of Franklin Bay, a herd of about twenty-five head of Caribou were sighted on the sloping mountain-side inland. By the aid of my glasses I could make them out to be a bunch of females with some of the calves of the preceding year ; they were travelling northward at a fair pace, and were among the advance guard to reach the coast, these animals evidently reaching Cape Bathurst by the 15th of the month. They were travelling pretty nearly in single file during the hour they were in view.

When these animals discover the hunter or traveller they will generally run around him in a circle until they get wind of him, when they are off ; but in running this circle, I may add that their judgment as to the distance a rifle ball will carry is very good. While thus circling around I have often been amused at the manner in which they carry one hind leg. A novice in the hunting field, after having fired a shot in their direction, would think that he had broken one hind leg of each member of the herd.

The destruction of Caribou is vastly greater among the Barren Ground or small Caribou of the far North than among the larger Caribou further south, and I can hardly agree with a well-known writer who, after a trip down the Yukon on a river steamer that carried him rapidly through the territory, says, "at one time huge herds of reindeer roamed wild over the mossy plains of



o Rock Mounds
1. Hunters, Women and Children
2. Caribou
3. Hunters with bows and arrows
4. Kiaks

Fig. 4. Diagram of an Ideal Eskimo Trap for the Capture of Caribou, used previous to the Advent of the Rifle.

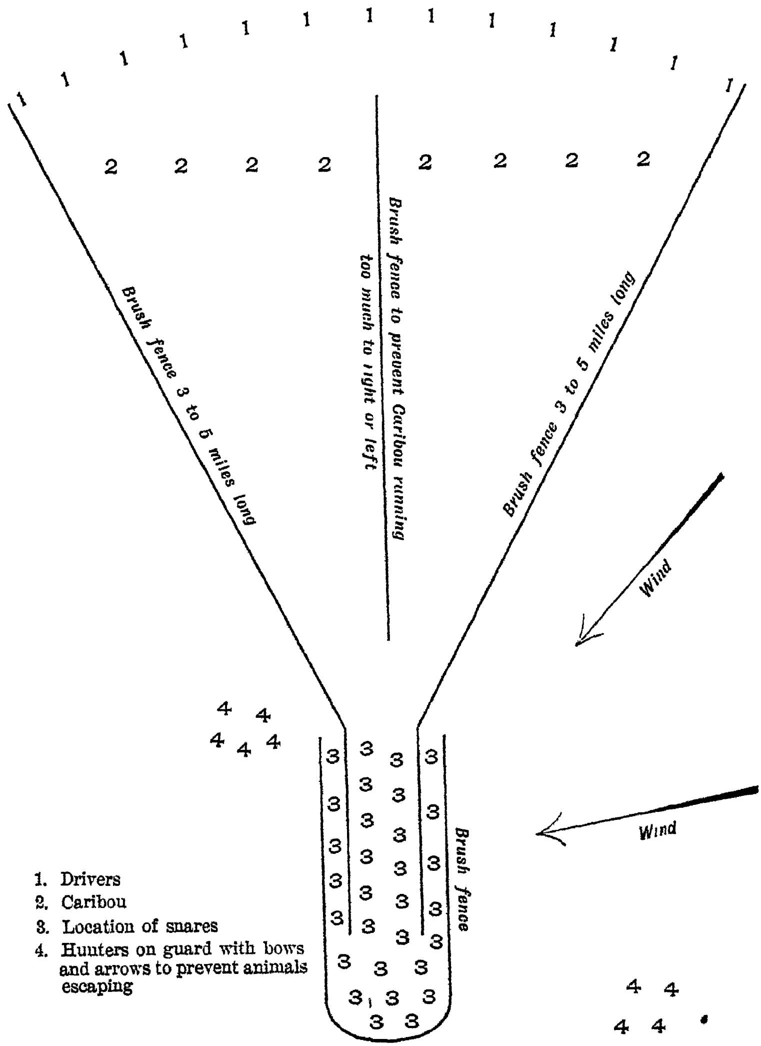


Fig. 5. Method of capturing Caribou formerly employed by the Loucheux Indians.

Alaska; a time came, however, when the Esquimaux grew so 'civilized' as to possess (and own) guns, the natural result being that the reindeer were exterminated for sport, not for meat."

Very little game do our northern Indians or Eskimo kill for the sport of shooting, and, with or without modern firearms, these people, if left to themselves, would never exterminate their game, and especially is this true of the Eskimo. It is the presence of the white man among the natives that is so dangerous to such animals as the Caribou.

Our northern Indians, as they formerly roamed over their hunting grounds, following the lakes and streams, lived much of the year upon fish, as they do still, although possessing firearms, and they were capable of making beautiful nets of the willow bark for the purpose of taking fish, food being thus acquired with much less labor than attends the hunting of large game.

When they resort to the hunting field it is nearly always for the purpose of obtaining furs; the flesh of the Bear, Beaver, Lynx, Marmot, and Muskrat, with an occasional Moose, and some birds and fish, furnish the greater part of their food; they formerly hunted Caribou and Sheep only in the fall when in need of their skins for clothing, at which time the flesh would also be utilized.

But now numerous trading posts must be supplied with both meat and skins, and the natives, while killing this meat for the posts, must live and support their families and dogs on the same flesh, all of which greatly increases the slaughter of these animals. Our Eskimo are practically all fish eaters, and the custom has been for them to obtain the principal part of their food from the water, killing every fall just enough Sheep and Caribou, principally Caribou, to provide them with clothing for the winter; and the possession of firearms would never have materially changed this, but for the fact that both the Whales and the Walrus in Bering Sea waters have been very much reduced in numbers during the past thirty years by the white man, which has naturally had a tendency to take the Eskimo hunter more inland. But the real key to the problem of extermination of our northern Caribou is the demand of the white man for the flesh and skins of this animal. The large whaling fleets in Bering Straits, and as far north as Point Barrow, have created a demand for the flesh of the Caribou and they are slaughtered by the thousand for the pur-

pose of barter; now this demand has been extended, by this fleet of whalers, along the Arctic coast as far east as Cape Parry.

One winter fifteen vessels wintered at Herschel Island, and I am reliably informed that these vessels each used from 10,000 pounds to 20,000 pounds of Caribou meat, an aggregate of over 300,000 pounds in one winter, principally the saddles; at the head of Franklin Bay, in the winter of 1897–98, four ships used of the same kind of meat about 90,000 pounds, and at Cape Bathurst, in 1898–99, one vessel used in the neighborhood of 40,000 pounds.

We may clearly infer from this that it is not the presence of the modern rifle alone, nor is it the sporting proclivities of our Eskimo, that exterminate these animals, but the demand of the white man, who offers in trade for the meat thus obtained, tea, tobacco, molasses and calico.

It would be with considerable hesitation that I should criticise white men wintering in such high latitudes, and subject to frequent and at times serious ills from the constant use of tinned foods, for purchasing this meat in such quantities as they do, even though I know it means the speedy extinction of the Caribou.

Inland from Darnley Bay, and on Bathurst Isthmus, the old stone mounds are yet in place, where the Eskimo formerly drove and impounded the Caribou, slaughtering them with bow and arrow; and to the east of the Mackenzie Delta, in the Rat River country, and again to the west of the Rocky Mountain range, in the Bell River country, may be found the decaying brush fences between which the Loucheux tribes of Indians at one time, not very long ago, drove the Caribou into the raw-hide snares set for them, thus securing them in large numbers. As I had an opportunity of observing the remains of these pounds, I present herewith diagrams representing these two methods.

Ursus richardsoni *Reid.* Barren Ground Bear.—The Barren Ground Bear is found in the hilly regions east and north of Great Bear Lake, in the low part of the Rocky Mountain range west of the Mackenzie, and in all probability to the Colville, and perhaps in the country forming the headwaters of the Peel River and the upper tributaries of the Yukon, among bald ridges above timber line. It shades in color from a dirty écru to brown,

and in spring, when quite faded, at a distance may be mistaken for a white bear.

Ursus middendorffi *Merriam.* KADIAK BEAR.—The Kadiak Bear inhabits the Kadiak group of islands, the Alaskan Peninsula, the Kenai Peninsula, the region back of Prince William Sound, the Sushitna and Kuik River regions, and the Alaskan Mountains, but I did not hear of their crossing this range into the interior.

Ursus dalli *Merriam.* YAKUTAT BEAR.—This Bear appears to occupy the greater part of the coast country between the Copper River and Lynn Channel, but evidently does not extend its range east of Lynn Channel, nor south of Chicagof Island.

Ursus sitkensis *Merriam.* SITKA BEAR.—This large brown Bear ranges well south through the Alexander Archipelago and into the coast range of the mainland to the east of these islands. The Iskoot, the largest tributary of the Stickine River, is quite noted for its numbers of these huge beasts; and the Indians are afraid to shoot them when hunting alone.

Ursus emmonsi *Dall.* GLACIER BEAR.—I did not hear of the Glacier Bear except in the St. Elias range of mountains, the headwaters of the Alsek, White, Tananna, Copper, and Sushitna Rivers.

Ursus horribilis *Ord.* GRIZZLY BEAR.—The Grizzly appears to range throughout the entire limits of the northern Rocky Mountains, and over much of the high mountain country west of the Rockies in Alaska and British Columbia.

Thalarctos maritimus (*Phipps*). POLAR BEAR.—The occurrence of the Polar Bear along the Arctic Coast in winter is materially influenced by the proximity of open water, it seldom visiting land, except in the neighborhood of the carcass of a whale. As I saw skins of females taken by the Eskimo while hunting seals along the open water at different times during the winter, it seems probable that they do not hibernate for any considerable length of time.

Lutra canadensis (*Schreber*). OTTER.—The Otter becomes somewhat rare in the extreme North, but is found in limited numbers almost to the limit of the growth of spruce forests. Very few of the skins taken furthest north by the Loucheux find their way to the furrier, as these people universally make them into winter caps.

Gulo luscus (*Linn*). WOLVERINE.—The Wolverine is found throughout the North, in timber and on the barrens, and I saw them far out on the ice of the deep bays along the coast.

The Eskimo use every skin they kill for trimming their deer-skin suits, and often buy them from the Indians of the interior for this purpose. The natives claim that the Wolverine and Wolf never meet without doing battle to the death, and that the Wolf is not always, though generally, victorious.

Putorius (Lutreola) vison (*Schreber*). AMERICAN MINK.—The Mink is taken in limited numbers along the banks of nearly all the wooded streams.

Mustela americana *Turton.* MARTEN.—The Marten is found throughout all the timbered regions, and is the principal fur received at the most northerly posts of the Hudson Bay Company. It is reported as being very plentiful at times, but as very scarce at others, and the traders and natives say they die off periodically. At Fort McPherson the trader told me they were as numerous now as when the post was first established, fifty years ago.

WOLVES.—I found the Black Wolf to be very much the most common variety throughout the Stickine and Liard River countries. The Black and the Gray were in about equal numbers along the Mackenzie, and the White or very light Gray Wolf the only one to be found along the coast. These animals are very little hunted for their skins, and were it not for the fact that they so often kill and eat each other they would become dangerously numerous.

FOXES.—Red, Cross, and Silver Foxes are found throughout the mainland of the North, but the skins of these animals in the extreme North do not have, according to my observations, as

perfect and beautiful coats as the animals living further south. The belt of country just inside of, and following the coast range in British Columbia, Northwest Territory, and Alaska, is evidently the most prolific in these animals, and yields the largest per cent. of choice skins of any part of the Northwest.

The skins of the Blue Foxes taken along the Arctic coast are inferior in quality to those of the Alaskan Peninsula and the Pribilofs.

Our knowledge of the Foxes of the North and Northwest is evidently very little in advance of our knowledge of the Caribou. It is, to say the least, very imperfect. There are the Silver-gray or Black, the Cross, the Red, the Blue, and the White. I have heard it said by one who claimed to know that the first three named were all of one common stock. Three years of very careful study and inquiry on my part in the very home of these animals failed to bring to light any positive proof either way, but I satisfied myself that the anatomy of no two of these varieties is alike.

The trading posts at Telegraph Creek, British Columbia, produce very much the largest number of skins of the Silver, Cross and Red Foxes of any one district in the North, and average yearly about 100, 500 and 2000 skins of each respectively. The Liard and Mackenzie River districts produce very few Silver Foxes. Large numbers of White Foxes are taken all through the Northern Hudson Bay and Arctic coast districts, but very few Blue Foxes are taken there. The Alaskan Peninsula and the Pribilofs constitute the real home of the Blue Foxes, and the skins taken there are far superior to those taken along the Arctic coast.

Undoubtedly the finest Red Fox skins produced in America come from the Nushagak River region. The Nushagak empties into Bristol Bay, an arm of Bering Sea. Silver Foxes placed on Afognak Island for breeding purposes reproduced Silver Foxes.

Much additional matter gathered during my travels in the North bearing on this subject might be of interest, but would make this paper of too great length.

Lynx canadensis *Kerr.* CANADA LYNX.—The Canada Lynx is common in the Stickine and Mackenzie River countries,

and especially abundant throughout the Liard River region. Traders and Indians are unanimous in their declaration that this animal is always numerous or scarce according to the number of rabbits in the country; that during the seasons of scarcity of rabbits, through death from disease or otherwise, the Lynx is proportionately scarce.

RODENTS.—Beaver and Muskrats are found to some extent everywhere about the lakes and streams. The Muskrat is extensively hunted throughout the Mackenzie Delta, Fort McPherson generally receiving from 12,000 to 15,000 skins every spring.

I saw Spermophiles sitting on their mounds among the hills to the east of Darnley Bay early in April, during very cold weather.

Natives informed me of the existence of Flying Squirrels as far north as 60°, but I saw none on my whole trip.

A small rodent, brownish gray in summer and white in winter [Lemming], I found on the Arctic coast, was a peculiarly interesting little animal. The whalers universally claim that they never find them except just after a storm, and that when they find them on top of the hard snow, appearances indicate that they have dropped on the snow from the clouds, and that after running around in a small circuit, they keel over and die. It is probable that they may come up to the surface of the snow during wind storms and are then blown from the ridges for some distance, and falling on the hard snow or ice they die. One secured at Herschel Island and placed on a sheet of sensitized paper spread on a table gave a very clever exhibition of the manner in which it must dig through snow or earth. It would not try to get away but would double up, with its feet seemingly all in a bunch, and then move them with such rapidity as to create a buzzing noise, in its attempt to make a hole through the paper. The movement of its feet was astonishingly rapid.[1]

INDIAN AND ESKIMO METHODS OF CAPTURING GAME.

The Indians generally snare the Bear, and in some districts still snare the Moose, Sheep, and Caribou. Beaver are now almost everywhere caught with the steel trap, although not many years

[1] [Mr. Stone obtained specimens of both *Lemmus* and *Dicrostonyx* on Herschel Island.—J. A. A.]

ago they netted them. Foxes are also taken with the steel trap. The Lynx, Rabbits, Marmots, Squirrels, and sometimes Grouse are taken with snares.

The Otter is taken with the steel trap, the Wolverine, Marten, and Mink in dead-falls. The few Wolves that are killed are usually shot.

The Eskimo kill the White and Blue Fox with dead-falls ; they spear the Muskrat, and shoot the Bear, Wolf, and Wolverine.

Article VI.—NOTE ON THE WOOD BISON.

By J. A. Allen.

The Museum has recently obtained a head (skull and unmounted head skin) of the Wood Bison, taken by Indians near Great Slave Lake. The exact point is not known, but it is evidently a freshly killed specimen, and is in excellent condition. It is a young male, probably about four years old, the second upper molar being wholly unworn, and the third molar not having yet broken through its alveolus. Compared with specimens of the Plains Bison (*Bison bison*) of corresponding age, it is rather above the average size of the latter, with the base of the horn cores relatively thicker. The head skin has the whole pelage darker, softer, and more silky than the Bison of the Plains, this specimen agreeing, in this respect, with several mounted heads of the Wood Bison I have seen in the possession of dealers within the last few years.

The present specimen confirms, as far as it goes, the characters recently assigned to the Wood Bison by Mr. S. N. Rhoads (Proc. Acad. Nat. Sci. Phila., 1897, p. 488), and quite warrant its recognition under the name *Bison bison athabascæ*, applied to it by Mr. Rhoads. Formerly it doubtless completely intergraded with the southern form. Now that it is on the point of extinction, the following summary of its recent decadence may not be without interest.

As is well known, the American Bison formerly ranged continuously from the northern boundary of the United States northward over the Saskatchewan plains to the region about Great Slave Lake, in latitude 60° north, and even, according to Richardson,[1] "to the vicinity of Great Marten Lake, in latitude 63° or 64°." Their range in the north, as well as in the south, gradually became more and more restricted, the last remnants consisting of only a few widely separated bands.

There is abundant historic evidence to show that the Wood Bison formerly ranged from the Liard River, in latitude 60°, eastward to the eastern end of Great Slave Lake, and from the district just northwest of Great Slave Lake southward, including the half-open country on both sides of Great Slave River, to the

[1] Fauna Bor.-Am., I, 1829, p. 279.

western end of Lake Athabasca, and westward to the east base of the Rocky Mountains. On my map,[1] intended to show the approximate range of the Bison in 1875, its northern limit is given as not extending much beyond Peace River, while in 1889 Mr. Hornaday gave its supposed area as a very limited district, wholly to the south of Peace River.[2] It is quite probable that both maps were in this respect erroneous. Mr. Hornaday's plotting of this portion of his map was doubtless based on Prof. John Macoun's statement in his 'Manitoba and the Great North-West,' published in 1883, in which he says (p. 342): "In the winter of 1870 the last buffalo were killed north of Peace River; but in 1875 about one thousand were still in existence between the Athabasca and Peace Rivers, north of Little Slave River."

According to Warburton Pike,[3] in 1890 "a few bands of buffalo" were scattered over a considerable area of country between the Liard River and Great Slave Lake, and thence south to Peace River. "Sometimes," he says, "they are heard of at Forts Smith and Vermillion, sometimes at Fort St. John close up to the big mountains on Peace River, and occasionally at Fort Nelson on the south branch of the Liard. It is impossible to say anything about their numbers, as the country they inhabit is so large, and the Indians, who are few in number, usually keep to the same hunting-ground." The site of his own successful hunt for these animals, in February, 1890, was on a tributary of Buffalo River, about fifty miles south of its entrance into Great Slave Lake.

It was near this point that Frank Russell hunted them in 1894, with the same Indian guide, but without success. He says: "At the end of the fourth day [from Fort Resolution] we reached the northern limit of the buffalo range, perhaps fifty miles south of the Great Slave Lake." Owing to stormy weather, Mr. Russell failed to reach the herd, being compelled to turn back without seeing a single bison. Concerning their numbers, haunts, and prospects he writes as follows[4]:

"The herd at present consists of a few hundred only. They are so wary that but one effective shot can be fired when they be-

[1] The American Bison, Living and Extinct. Mem. Geol. Surv. Kentucky, Vol. I, Part ii, 1876, and Mem. Mus. Comp. Zool., Vol. IV, No. 10, 1876.

[2] The Extermination of the American Bison. Report of the U. S. Nat. Mus., 1886–87 (1889), pp. 369–548, pll. i–xxii.

[3] Barren Ground of Northern Canada, 1893, p. 143.

[4] Explorations in the Far North, 1898, pp. 231, 232.

take themselves to instant flight, and, as with the moose, pursuit is altogether futile. They cannot be hunted in summer as the country which they inhabit is an impenetrable, mosquito-infested, wooded swamp at that season. . . . They can only be killed by stalking in midwinter when their pelage is at its best. . . .

"The Indians along the Peace and Slave Rivers make occasional trips into the buffalo country with dog teams to establish lines of marten traps. When they discover a band of buffaloes they of course kill as many as they can, but they have not made systematic efforts to hunt them for their robes, as they have the musk-ox. Fortunately, the officers of the Company have exerted their influence toward the preservation of the buffalo, not trading for the robes, until the recent advent of rival traders. During the winter of 1892–3 forty buffaloes were killed, the largest number that had been secured for several years. I saw most of these robes which were very dark, the hair thick and curled, making a robe superior to that of either musk-ox or plains buffalo; they were so large that the Indians had cut many of them in halves for convenience in hauling on the sleds.

"From 20 to 100 MB [$10 to $50] are paid for the robes. The traders are trying to induce the Indians to preserve them as mountable skins.

"The northern limit of the range of the buffalo, as given by Mackenzie, was the Horn Mountains, north of the Little Lake. Père Ruore, of the Saint Michael Mission at Rae, who has crossed the Rae-Providence traverse several times, assured me that he had seen buffalo skulls on the prairies which lie within fifty miles of Providence, northwest of the western end of the Great Slave Lake. I saw no remains of buffaloes when I crossed these prairies in December, owing to the snow, but the country is similar to that south of the lake where they are still found.

"Black Head, an old Yellow Knife chief, living at the mouth of the Rivière au Jean, told me that he had killed 'plenty of buffaloes' in the delta of the Slave River. About fifteen years ago a few were killed near Liard, but they are seldom seen in that quarter. They formerly frequented the 'Salt Plains,' forty miles northeast of Fort Smith. Franklin's party killed a buffalo in that vicinity at the time of their visit in 1820.[1] Richardson states that

[1] Sir John Franklin, Narrative, p. 177.

in 1848 there was an abundance of deer and buffalo meat obtainable on the Salt Plains."[1]

Still later information is furnished by Thomas Johnson, in a quotation from the report of Game Inspector Jarvis to the Canadian Government, published in 'Forest and Stream' for Oct. 23, 1897 (Vol. XLIX, p. 323). His inspection of the region embracing the present range of the Bison was made in 1897, and in his report he says: "I have taken great pains in making as thorough inquiries as possible in connection with the buffalo, their habits, number, and range. The range of a scattered band of about 300 is from Peace Point to Salt River, and from Salt River to within twenty miles of Fort Resolution, on Great Slave Lake. I met a Mr. Handbury, an English sportsman, who is on a hunting expedition. He had just returned from an unsuccessful buffalo hunt, but he saw fresh tracks and beds of about sixty buffalo. Mr. Handbury returns this year, but the fear of a $200 fine will hardly prevent his hunt. . . . If it be the intention of the Government to protect these nearly extinct animals, it can only be done by placing officials on the spot. I have in the case of buffalo and other game impressed on all hunters and other interested persons the necessity of obeying the game act, and have left printed notices where practicable."

Mr. Rhoads, in his 'Notes on Living and Extinct Species of North American Bovidæ' (Proc. Acad. Nat. Sci. Philadelphia, 1897, p. 497), published a letter from Mr. H. I. Moberly, of the Hudson Bay Company, dated Nov. 9, 1897, in which Mr. Moberly states: "They lived formerly from the beginning of the wooded country north of the Saskatchewan to Great Slave Lake, and further north along the east slope of the Rocky Mountains. At present there are not more than two hundred and fifty to three hundred alive, and they are in two bands, one on the lower Peace River, north of it, and run from close to Great Slave Lake at Peace Point, which is some ninety miles below Fort Vermillion. The other is on the upper Hay River and ranges between Peace River and Liard River, and run down some two hundred and fifty miles east of the Rocky Mountains and up to the foot of the Rocky Mountains."

This brings the history down to Mr. Stone's report, published

[1] Arctic Searching Expedition, p. 149.

in this volume of the Bulletin (*antea*, p. 41), in which he states that he does not think the present number exceeds 50, and that their complete extinction, in spite of the efforts of the Canadian Government to protect them, will be consummated within the next three years.

The number of Wood Bison estimated to exist at different times during the last ten years may be summarized as follows :

Hornaday, 1889	550
Russell, 1894	a few hundred.
Jarvis, 1897	about 300.
Moberly, 1897	250–300.
Stone, 1899	50.

From the above it appears that the Wood Bison, during the last six years at least, have occupied a portion of country considerably to the north of the region where they were located by Mr. Hornaday in 1889, and by myself in 1876. It is likely, however, that they never wholly forsook the region they now occupy, and that the two maps above cited were in this respect erroneous. It is pretty safe now to assume, however, that they have been entirely exterminated from their former range south of the Peace River, and that a few years more will suffice for their complete extermination.

The extirpation of the Plains Bison (*Bison bison*) has already been practically effected. Mr. E. Hough of Chicago, an excellent authority on this subject, states in a recent number of 'Forest and Stream' (Vol. LIV, No. 12, p. 248, March 31, 1900), that in 1895 there were possibly 20 to 25 wild examples in different parts of Montana, Wyoming, and Colorado, and 100 to 125 in the Yellowstone National Park. Now (March, 1900) he says : "On the face of all discoverable information on this head it is safe to say there are not a dozen live wild buffalo outside the Yellowstone Park in the United States, and if there is a single one I do not know where it is. Inside the Park there may be 20 head or so."

The different domesticated herds he estimates may contain, all told, "between 300 and 500."

Thus the American Bison is already practically exterminated in the wild state, and its perpetuation depends upon the care and skill exercised to preserve the domesticated herds.

Article VII.—SYMBOLISM OF THE ARAPAHO INDIANS.

By ALFRED L. KROEBER.

During the past summer the writer undertook an investigation of the Arapaho Indians, now settled in Oklahoma Territory, on behalf of the American Museum of Natural History. The means for this expedition were provided through the generosity of Mr. Morris K. Jesup. Some of the results of this investigation are contained in the following paper. The Arapaho Indians speak a language belonging to the Algonquin family. In culture they belong to the Plains Indians.

In investigations of the art of primitive tribes from different parts of the world, it has several times been shown that geometric ornaments that are apparently merely decorative are conventionalizations and abbreviations of pictorial designs. The same is true among the Arapaho. Even what seems most purely ornamental is readily shown, by inquiry, to be realistic. It can be stated that every decorative design of the Arapaho is also pictorial. This is confirmed by the direct statements of the Indians themselves.

Primitive pictorial art, setting aside its purely decorative aspect, may be said to consist of the reproduction of a few salient features of the object to be represented. Two tendencies can cause a change from this state. There may be a seeking after fidelity to nature. This will cause the art to be more realistic, more imitative. Or there may be a tendency to further emphasize and exaggerate the salient features; that is, to think the object, instead of see it. This will cause the art to be more symbolic. The first tendency develops into art as we know it; the second ultimately into writing.

Arapaho art is strongly imbued with the second of these, the symbolic tendency. This, its most marked feature, is the subject of this paper.

The media of this symbolic art are embroidering with colored beads, quills, or fibres; carving in outline or bas-relief; and painting. Pottery and textile fabrics do not occur. There is practically no three-dimensional carving (sculpture). In appearance

the art resembles closely that of the Siouan tribes. Its decorative value is mediocre.

To discuss the symbolism of Arapaho art, it will be convenient to classify the symbols into representations of animals, of plants, of physical nature, of objects made by man, and of abstract ideas.

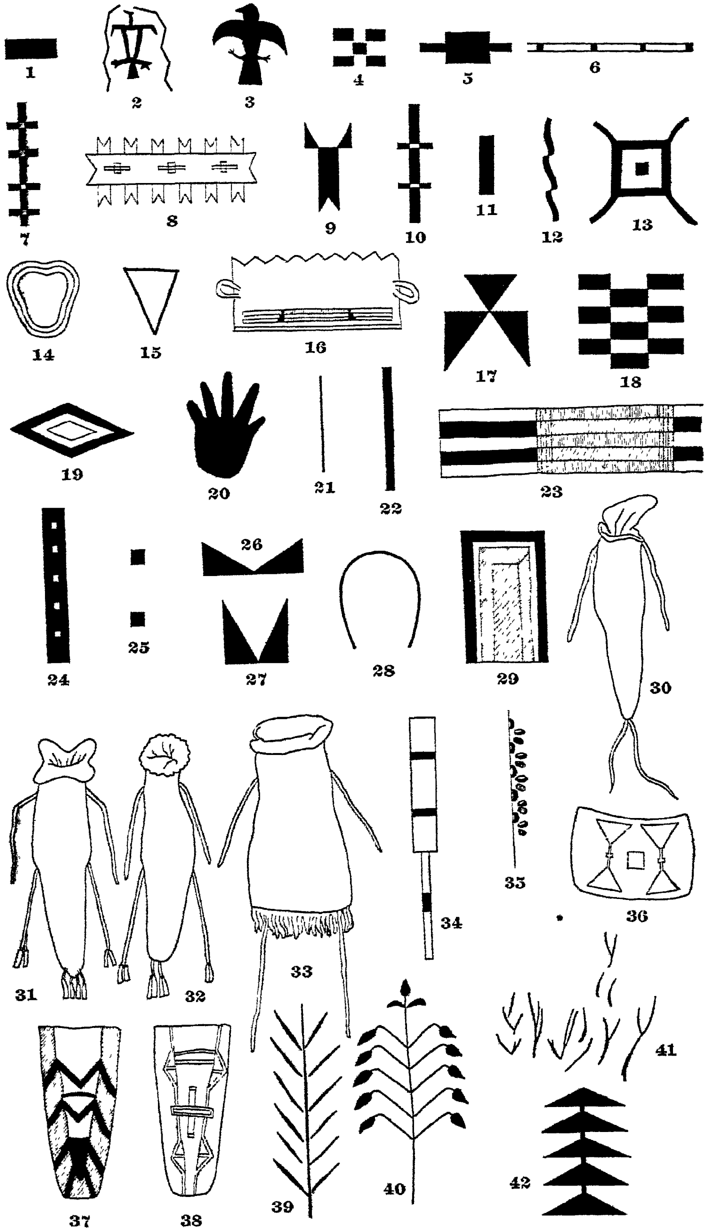
Designs of animal origin, generally of preponderating frequency among primitive races, are abundant among the Arapaho also, but they by no means dominate.

One would expect to find the buffalo, which provided practically all the means of life, giving rise to many of the symbols in use. This is the case, but representations of the animal itself are rare, and they are reduced by simplification to a rectangle of solid color (Fig. 1).[1] It will be seen later that this practically coincides with the symbols for the earth and for abundance, and this coincidence is evidently the cause of the scarcity of decorations representing the animal itself. Of birds, the thunder-bird or eagle (Fig. 2), and the crow (Fig. 3) occur. They are represented in much the same way as on our silver coins. The head is either turned to one side or stretched forward. The thunder-bird is characterized by lightning proceeding from his eye, while a line from his beak or his tail denotes the rain which he causes. The turtle is represented by five small squares arranged in quincunx (Fig. 4), or by a rectangle with two projections (Fig. 5). On certain dancing-belts a strip of hide wound with corn-husk (Fig. 6) represents a snake. The centipede (Figs. 7, 8), the crayfish or scorpion ('crab') (Fig. 9), the dragon-fly (Fig. 10), caterpillars (Fig. 11), maggots or grubs (Fig. 12), and the spider (Fig. 13) are found chiefly on foot-wear.

Other animal forms are found executed more realistically on certain paintings or carvings. These animals are the buffalo, turtle, weasel, kit-fox, deer, antelope, fish, crow, thunder-bird, magpie, bull-bat, duck, etc. These representations, however, are scarcely conventionalized enough to be regarded as symbols, and are really pictographs.

Separate parts of the body, animal and human, are not infrequently represented. The heart is roughly triangular in shape (Figs. 14, 15). It is sometimes represented in place in animals,

[1] A list of the catalogue numbers of the specimens on which the decorations here discussed are found is given at the end of this paper.



Figs. 1–42. Symbols of the Arapaho Indians.

sometimes alone with a spiritual signification analogous to that which it bears with us. The brain and eyes (Fig. 16) are represented (on a head-dress representing a buffalo) by a band of hide partly covered with a design of corn-husk ; on each side is a loop made of a strip of hide wound about with corn-husk. In this case the conventionalized ornaments resemble the objects represented very little, except in their position on the head of the wearer. Heart and lungs (Fig. 17) are symbolized by two right-angled triangles and a smaller isosceles triangle joined to them by its vertex. A moccasin with a checkerboard design, the squares being alternately left empty and filled with beads, represents the rough interior of buffalo intestine (Fig. 18). A rhomboid, which ordinarily occurs at the centre of a design painted on parflêche bags, is both the navel and the eye, the latter perhaps on account of its red and yellow interior (Fig. 19). The hand (Fig. 20), because it throws the ball, is found painted on that object.

One of the most frequent symbols is that for a buffalo path or trail, a line (Fig. 21) or stripe (Fig. 22). This is often enlarged by repetition, in which case the adjoining parallel stripes are of different colors. It is then generally further complicated by transverse stripes, which introduce more colors and give a pattern that is shown in Fig. 23. Exactly the same design, however, is also interpreted as the trails caused by the ends of the tent-poles being dragged along the ground when a camp moves ; while the transverse stripes now become ravines that have to be crossed, or halting-places. In fact, this symbol, a stripe or a line, denotes any path whatsoever. The running to and fro of children at play is represented by a number of broad lines running across the foot of a child's moccasin, and a line beneath the sun or the morning star denotes the course of these bodies as they rise.

Buffalo-tracks are represented by a line of small squares within a broader stripe (Fig. 24). Small black squares on a white ground denote rabbit-tracks in the snow (Fig. 25). Elk and antelope hoof-marks are shown by means of two right-angled triangles joined at one vertex. The elk-hoof (Fig. 26) has the triangles placed so that their longer legs are in a line; the triangles in the antelope-hoof have their shortest sides in one line (Fig. 27). Horse-tracks are represented by horseshoes (Fig. 28), and

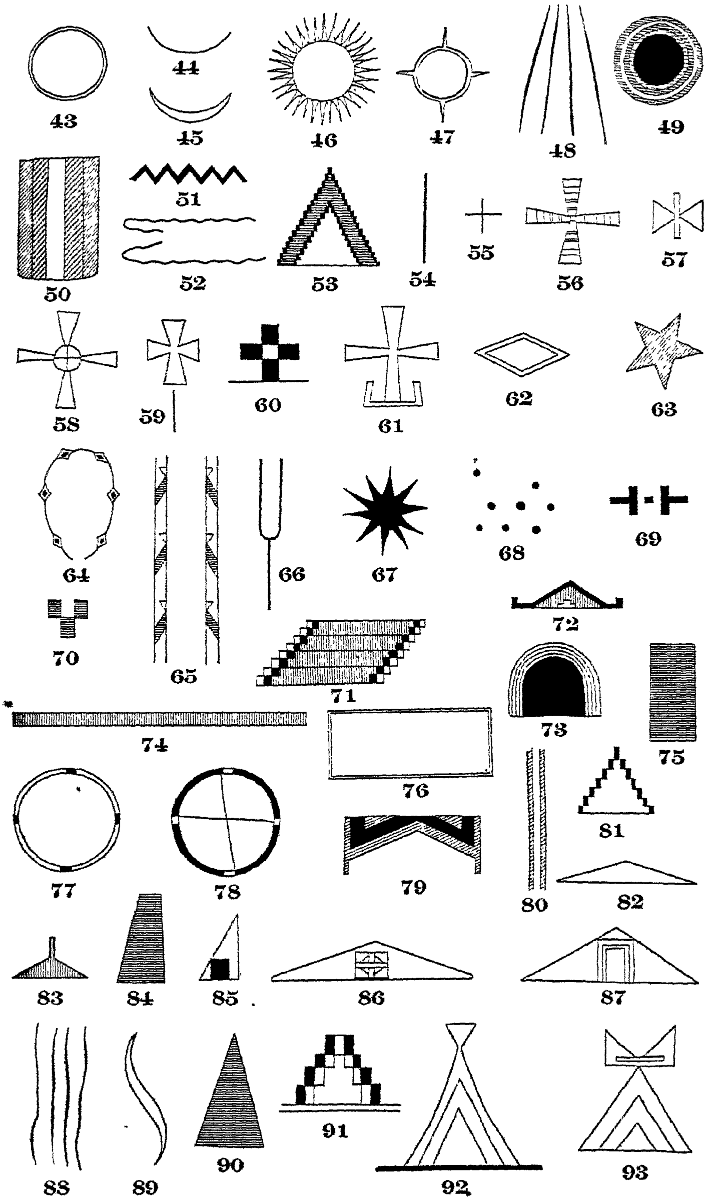
bear-claws, in one instance, by rectangles enclosing smaller rectangles, the nails being omitted (Fig. 29).

The Arapaho use small leather paint-bags, or pouches, in which they keep their body-paint. These bags generally represent small animals, such as the beaver (Fig. 30), fish (Fig. 31), lizard (Fig. 32), or frog (Fig. 33). The opening of the pouch is the animal's mouth, two strings that serve to close the opening are the forelegs, etc.; that is to say, the whole object that is to be ornamented is considered an animal. The Arapaho say that at the beginning of the world their ancestors had only the skins of these animals for paint-bags, and that thus the custom originated. These bags are partly covered with bead-work, and, as might be expected, the beading often carries out the idea that the whole bag is an animal. Thus we have the ribs (Fig. 34) and the tail-markings (Fig. 35) of the beaver, the four shoulder-joints of a frog and the food inside of it (Fig. 36), the markings on the body of the lizard (Fig. 37), etc. These symbols, however, are complex and many-colored, and scarcely suggest the part of the body intended, except by their position. Sometimes the surroundings of the animal are also indicated. A fringe at the bottom of a 'frog' bag denotes the grass in which the animal is sitting (Fig. 33); a 'beaver' bag has worked on it in beads the course of a stream, a beaver-dam, and beaver huts (Fig. 38). Finally we have such apparently irrelevant designs as spear-heads, tents, and the blue sky on a bag representing the beaver. It should be added that these paint-bags do not invariably represent animals. They are of interest because they are the only cases of adaptation of an object to animal or other forms,—a feature common to the art of many tribes, and particularly applied in objects made of pottery The Arapaho have not employed this device much, nor very consistently.

Ornamental designs derived from plants are unusual, as among most primitive tribes. Trees are represented by a rude though perfectly natural symbol (Fig. 39). In some cases this design represents only the cedar, while the leaf-bearing cottonwood is distinguished by additional green touches at the ends of the branches (Fig. 40). Grass is denoted by short straight lines at various angles to each other (Fig. 41), also by the fringe on the

paint-bag above (Fig. 33), and mushrooms by a series of triangles bearing stems (Fig. 42).

Inanimate nature furnishes a considerable variety and a great number of symbols. The sun is denoted by a circle (Fig. 43), the moon by a horizontal crescent (Figs. 44, 45). Each of these symbols, however, is also used for the other. Sun-rays are represented by straight lines radiating from the sun or extending downward from it (Figs. 46, 47, 48); in the sun-dance and the mescal ceremony, by a yellow buckskin fringe. The rainbow consists either of party-colored concentric rings within the sun (Fig. 49), or of blue, red, and yellow parallel, contiguous stripes (Fig. 50). The symbol for lightning consists of long zigzag or wavy lines, often issuing from the eye of the thunder-bird. Generally there are from two to four lines of different colors (Figs. 51, 52). In one rather elaborate design, broad yellow bands with red edges denote sheet and forked lightning (Fig. 53). Rain, as already stated, is expressed by a line proceeding from the thunder-bird (Fig. 54); strings or thongs attached to objects may also denote rain; and white or transparent beads at their ends, hail. The morning star has the cross for its symbol, but occasionally it is not distinguished from other stars. The cross may vary from two intersecting lines (Fig. 55) to a Maltese cross (Fig. 56), or similar forms (Figs. 57, 58), and may be elaborate in color. A perpendicular line beneath the cross represents the course of the rising star (Fig. 59); a horizontal line beneath it and in contact with it, the horizon, above which it is just beginning to rise, or its nearness to day (Fig. 60). Two short stripes on each side of the star are said to denote its twinkling (Fig. 61). Other stars are most frequently represented by a diamond or rhomboid of several colors (Fig. 62) in bead-work, and a five-pointed 'star' (Fig. 63) in carving or painting. Half a dozen rhomboids connected by a line running around the foot of a moccasin are a constellation, probably Corona (Fig. 64). Two white stripes with several colored marks upon them are the Milky Way (Fig. 65). This latter seems a cramped or abbreviated design, for the closely allied Cheyennes represent the Milky Way by a sort of elongated Y, a line which forks in its course (Fig. 66). The cross seems also to be used for ordinary stars, as are a number of other symbols (Figs. 67, 68, 69). A small design, consisting of three squares



Figs. 43–93. Symbols of the Arapaho Indians.

(Fig. 70), which is said to be half a star, is rather curious. Clouds are variously represented, as will be seen from Figs. 71, 72. In Fig. 73 we have the cloud as a dark area inside of lines representing the rainbow.

For the sky there would seem to be no symbol beyond the color. A line or band is sometimes interpreted as the sky; but in such cases its shape may be without significance, merely giving opportunity for applying the colors symbolic of the sky. These are light blue, dark blue, black, and yellow (for sunlight). The earth is usually green, though occasionally, when autumn is to be represented in contradistinction to spring, yellow or brown is employed instead. The shape of the symbol for the earth varies according to the idea of it that is most prominent. Where merely the surface of the earth is thought of, or the ground as it supports tents, trees, etc., a horizontal line or band suffices (Fig. 74). The earth conceived of as including and containing everything is represented either by a rectangle of solid color (Fig. 75), or by a hollow rectangle (Fig. 76), which is generally filled with other designs. The cosmic symbol more properly is a ring with four equidistant marks (Fig. 77), which are sometimes connected by lines (Fig. 78). The four marks are the four 'ends of the earth.' The similarity of this to the widespread cosmic symbols occurring from Central America northward is evident.

The curious three-colored design shown in Fig. 79 represents a lake. The exterior, which is pinkish in color, represents the red earth of the banks; the black is water; while the green above is floating scum. A stream of water with a beaver-dam and huts has already been mentioned (Fig. 38). Finally, lines forming the long sides of the rectangles which enclose the pattern painted on parflêche bags, and which usually denote the earth or the camp circle, are sometimes called rivers (Fig. 80). On the whole, representations of water are scarce. Mountains and hills, on the other hand, are correspondingly frequent. The typical form is an isosceles triangle, which is made more or less obtuse (flat) according to circumstances, but is never more acute than an equilateral triangle (Figs. 81, 82). A slight variation is shown in Fig. 83, while Fig. 84 is an example from a freely painted composition. Mountains mostly covered with snow, but some of whose

dark rocks still appear, are represented by a design like that shown in Fig. 85. The mountain from which the buffalo issued to the world is frequently represented as in Figs. 86, 87, the square or cross denoting the hole or door. Snow is denoted by white, but sometimes white seems to be merely a neutral background. "Four destructive winds" are represented by four irregular wavy lines of different colors (Fig. 88). A sort of band or scroll encircling a stick is called the whirlwind (Fig. 89).

A frequent design, and one that might be expected, is the tent. This is a pointed isosceles triangle (Fig. 90), sometimes becoming equilateral (Fig. 91). With a small inverted triangle at its apex, it represents a tent with the poles projecting at the top (Fig. 92), while two small right-angled triangles added at the apex denote the triangular flaps that serve to control the ventilation (Fig. 93). A more realistic form, reminding one of pictographs, is sometimes painted or carved (Fig. 94). On the painted parflêches, the symbol of the tepee (Fig. 95) is colored green, yellow, and red. Here the green is the ground; the yellow, the skins of the tent; and the interior red, the fire. The small elongated or triangular marks at the base represent tent-pegs; when placed on the apex of obtuse triangles, these marks are monuments or piles of stones on mountain-tops, or old men's buffalo-robes hung on sticks stuck into the ground to be prayed to (Fig. 96). The camp circle is sometimes represented by the same rectangle that is the sign of the earth (Fig. 76). Similarly, the lines and bands and combinations of stripes that denote buffalo-paths, at other times represent trails of a moving camp, and ravines to be crossed, as already mentioned (Fig. 23). Arrow-heads and spear-points are variously expressed,—by acute isosceles triangles (Fig. 97), right-angled triangles (Fig. 98), or an open sharp angle (Fig. 99). A barbed arrow is shown in Fig. 100. A bow is represented merely by a stripe (Fig. 101). In this case, again, the position in the composition is more suggestive than the shape of the symbol itself (see p. 82). A more realistic representation of bow and arrow is, however, not wanting (Fig. 102).

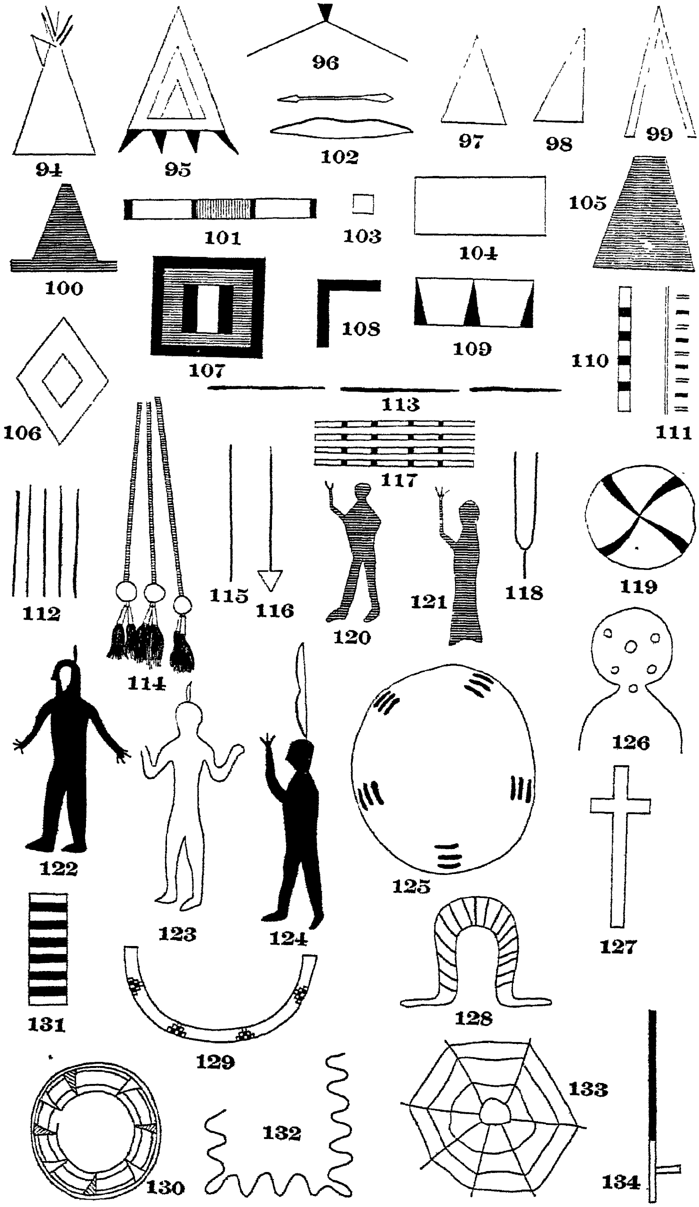
Symbols of abstract ideas have also been developed by the Arapaho. The same has been found by Ehrenreich among the closely-allied Cheyennes (Ethnol. Notizblatt, 1899, II, p. 27). It is difficult at times to get the exact meaning of the symbols, as

the Indians find trouble in using English abstract terms, and it is impossible as yet to state accurately the significance of the Arapaho words. Most of these designs, it is true, are so frequent that there is no possibility of a mistake; but many of the definitions must for the present be rather vague.

A common abstract symbol, perhaps the most common of all, is that called 'hiiteni,' which denotes abundance or the prayer for plenty. It varies considerably, but all the forms are connected with the square or rectangle. This, it will be remembered, is also the symbol for the earth and for buffalo. The close connection between the ideas is evidently reflected in the similarity or identity of their symbols. The form said to be the most typical of this symbol is a trapezoid. This symbol is never large in comparison with the object decorated; often it is minute. Among its forms are the square (Fig. 103), rectangle (Fig. 104), trapezoid (Fig. 105), rhomboid (Fig. 106), and square containing a rectangle (Fig. 107). It is usual, when the size of the symbol permits, to have its central portion of a color different from the rest. Several designs which are combinations of this symbol are shown in Figs. 108, 109, 110. A comb-shaped design (Fig. 111) was also, in one case, said to represent an abundance of buffalo, but was not the hiiteni.

Thoughts (reason, wish, prayer) are represented by lines, either parallel or end to end (Figs. 112, 113). Sometimes pendant strings wound with quills, or again small round mirrors, have the same signification. In one case there were appended to strings that bore this meaning, brass beads, small tin cylinders or cones, and dyed horsehair, which denoted the accomplishment of the thought, or thankfulness for the fulfilment of the desire (Fig. 114). The course of a message or prayer to heaven is denoted by a straight line (Fig. 115); the attention that the prayer is to receive, by a design similar to an arrow (Fig. 116). The heart is also used in an abstract sense in the symbolism of this tribe.

The four ages of man or periods of life, called 'hills' or 'divides' of life, are represented by four white bands, each with four black spaces at equal intervals upon it (Fig. 117). A line which for the greater part of its length is forked (Fig. 118), denotes life, which in youth is single, but thereafter is made double by marriage. A straight stripe, the sign for a path of any



Figs. 94–134. Symbols of the Arapaho Indians.

sort, may also symbolize virtuous life. Four circles of white, each with four black sectors or radii, denote the four generations of a hundred years each, of which the fourth since the creation of the world is now passing away (Fig. 119).

In these cases the idea of number becomes important, though there is still something characteristic, though not inherently suggestive, to symbolize the idea itself. There are other cases where only a number is represented, though a definite object is clearly meant. Thus, four lines on a belt worn in a certain dance denote the four days that the dance lasts. In another dance, lines on the leggings represent the number of 'coups' the wearer has counted. Sometimes a large number is signified by numerous lines, notches, or fringes, without any idea of the exact number being represented. Even colors are used to represent numbers. A green and a yellow strip or flap of buckskin, on the same object that bears the marriage symbol just referred to, also denote the duality of marriage, without any reference of one color to the husband and the other to the wife. A certain arrangement of black, red, yellow, and white, which recurs very frequently under various forms and correspondingly different significations, denotes, when on the parallel lines running across buffalo-robes, the four generations mentioned above.

The human figure (Fig. 120) is not often represented, except in painting and carving. It is generally in profile. A woman is distinguished by a long dress (Fig. 121). Spirits may be painted black (Fig. 122), or represented with a feather on the head (Fig. 123), but neither of these rules is without exception. In one case a bow is substituted for the feather (Fig. 124). In objects representing a head, paint around the face (on forehead, cheeks, and chin) is sometimes denoted by lines or dots (Figs. 125, 126). The Christian cross planted in the ground, and a horseshoe-shaped symbol filled with radiating lines (a halo), are designs used by a half-convert (Figs. 127, 128). A semicircular band containing triangles (Fig. 129) denotes the row of persons sitting in a tent during the mescal ceremony. In another case, eight small triangular marks along the inside of a circumference (Fig. 130) represent the vomitings that it is usual for each participant in the worship to deposit behind him in the course of a night. Sticks used as counters in guessing-games are represented by beaded

lines (Fig. 131). The two outlines seen in Figs. 132, 133, are symbols of the spider-web. A pipe is shown in Fig. 134.

Color is almost always used in Arapaho ornamentation. As is natural, it generally aids the realistic expression, and conforms as nearly as possible to the color of the object represented. In fact, sometimes it is only through the color that the meaning of a design becomes clear (*cf.* Figs. 11, 50, 79, 85, 122). When, however, the color of the object in nature is wanting, or unessential in the Indian's opinion, color is sometimes put on, as it seems to us, at random. Thus we have party-colored buffalo-tracks ; antelope-hoof marks in blue ; red, black, green, and yellow thoughts ; pink, green, and blue buffalo-gut ; and so on. It should be remembered, however, that the Indians declare, and believe, that they see various colors in stars, lightning, and similar objects, which to us suggest only an idea of brilliance ; and that colors are at times used to express the abstract idea of a difference, or a number, without any attempt at realistic representation. The tendency is to use colors, like forms, with pictorial intent ; but this is not carried so far as with forms, and there is a purely ornamental (*i. e.*, more than merely conventionalized) employment of color. The principal colors also have significations of their own, which they sometimes bear irrespective of the design in which they occur ; so that we may have a shape-symbolism and a color-symbolism in the same decorated object, each totally independent of the other. Thus, green is the earth ; red, mankind (both on account of blood and red paint) ; yellow, daylight, and hence sometimes heaven ; blue, the sky ; white, snow ; black, night.

So far, various designs and characters have been described separately. As a rule, however, they occur in combination. The relation or connection between the symbols in such a combination may be of three kinds. 1. The relation may be conventional, *i. e.*, fixed by usage. 2. Relation may be apparently wanting ; for instance, a moccasin is decorated with characters representing the earth, the heart and lungs, the dragon-fly, caterpillars, and stars. But in cases like this, the ornament often records a dream or vision, and this gives close associations to apparently disconnected symbols. 3. The relation between the symbols may be close, and the whole design may then even tell a story.

An instance of such coherence is shown in Fig. 135, representing a bag ornamented with bead-work. The blue background is the sky: in this flies the thunder-bird or eagle, whose red heart and white tail and wing feathers are shown. Below it are bands of yellow sheet-lightning: these are bordered by red zigzag or forked lightning. Triangles represent the mountain-tops, rising higher and higher, upon which the bird has successively rested in his upward flight. Below him the rain is falling: this fills a lake near the bottom of the whole design. At the edges is white snow, from which mountains emerge. At the top, however, where the thunder-bird is, there is so much heat that there is no snow. A design similar in character, though much simpler, worked in beads, is found on a moccasin (Fig 136). The long white stripe is a buffalo-path, in which a buffalo (shown by a green rectangle) is standing. A transverse stripe at the end is a hunter's bow; and from this barbed arrows (black triangular marks) have been shot into the buffalo.

Connected or narrative symbolism also occurs in the painting on a cylindrical case of buffalo-hide, used as a medicine-case. The design of this is shown, spread out flat, in Fig. 137. Below, on the right side, is the sweat-house into which the owner and maker of the case went before beginning his fast to acquire supernatural power. This ornament also represents a small mound in front of the sweat-house, on which a buffalo skull is lying. The fish-tail ornament just above this is the mountain on which the man fasted, and hence also represents himself. To the right of this, the crescent-topped design is 'the overseer' (the sun), also called 'the one that lights.' The pedestal or stalk of this figure represents 'information' (supernatural power) flowing down from this being to the earth (the horizontal line). At the extreme left, the same design is a representation of himself after he had acquired information and power; and to the right of this, the fish-tail ornament now represents this very medicine-case. But the case is made of buffalo-hide, and his supernatural power consisted largely in control of the buffalo; therefore this same symbol also denotes buffalo. Below, on the left, is the sweat-house into which he went after his fast.

It has been mentioned that the symbols of the earth, the buffalo, and of prayer for plenty (hiiteni), are often identical. The

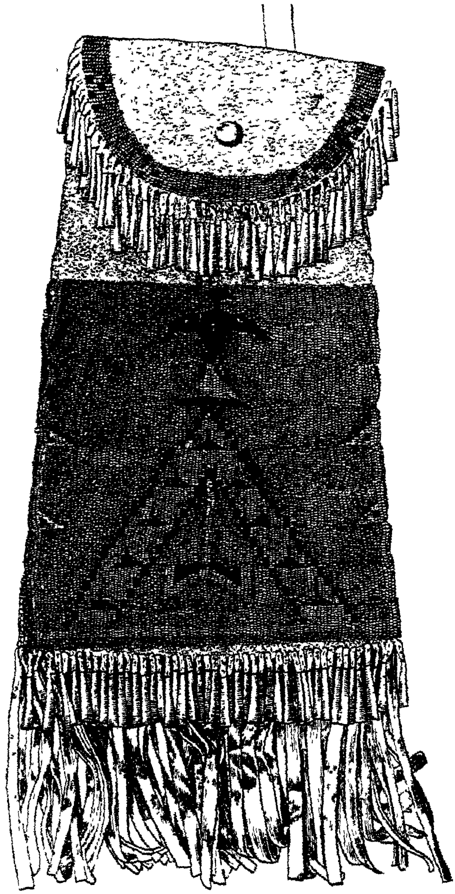


Fig. 135. Beaded Pouch.

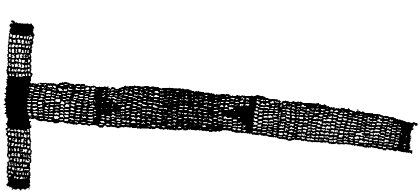


Fig. 136. Design from a Moccasin.

affinity between them is strikingly shown by the painting represented in Fig. 138. The whole design is a buffalo, and stands halfway between a realistic picture and the usual plain rectangular symbol. Body, head, legs, and tail can easily be made out. At the same time the whole design is also called hiiteni,— the name of the symbol for prayer for abundance. Abundance is also denoted by the short lines at the extremities of the legs. The three lines at the side, and the small vertical central line, are buffalo-paths. It is curious that they are so unsymmetrically disposed. The two rectangles in the centre signify the earth,— the outer one, which is red, denoting the earth proper ; the inner one, which is green, grass. The maker of the design could give no other explanation of the repetition of the head at the rear end of the body than that the whole painting was a copy of a dream.

Arapaho decorative art thus bears resemblance to the system of pictographs used by North American Indians. The number of symbols is considerable ; several of them express abstract ideas ; connection between the symbols is usual, and they may even tell a story. All this suggests picture-writing.

At the same time there is no real pictography. The symbols described cannot be read. One man may guess the meaning of another's design ; but he may also fail to understand it, or may even misinterpret it.

Then, too, it must not be forgotten that this art, whatever else it may be, is also ornamental. The symbols are decorative as well as symbolic. They are often duplicated, to make the two sides of the ornamented object symmetrical. This would not occur in pictography. Sometimes a pattern is even formed by means of repetition of a symbol. Another decorative device that has been mentioned is that of ornamenting an object as if the whole of it were an animal. At times a single symbol is distorted to make it symmetrical. These devices are all purely decorative in object.

All these methods of ornamental treatment, however, are carried out in Arapaho art just enough, as it were, to bring out its decorative character, and no more. Patterns formed by repetition are rarely found (see Figs. 18, 23, 42). Distortion for symmetry is infrequent and very slight (see Figs. 1, 5, 8, 10).

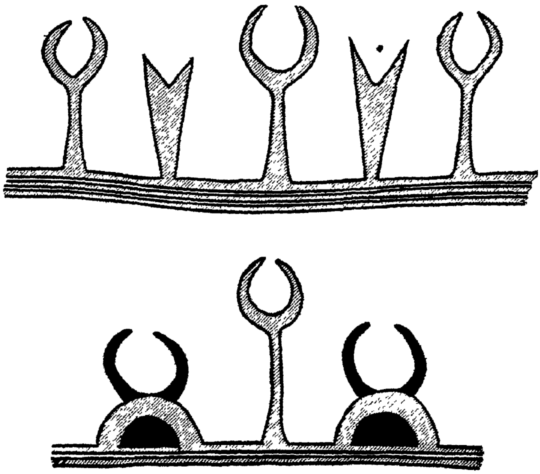


Fig. 137. Design from a Cylindrical Leather Case.

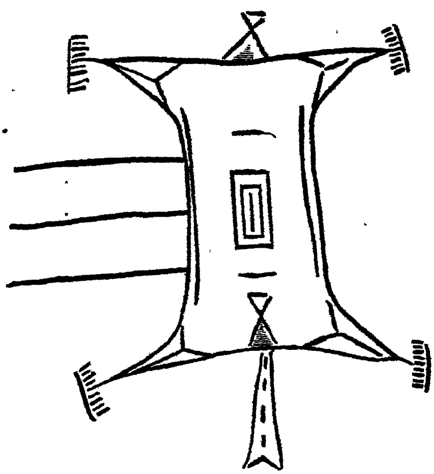


Fig. 138. Painted Design from a Blanket.

Decoration of a whole object as an animal is practically confined to one small class of pouches. To sum up, both a decorative and a symbolic tendency must be reckoned with in Arapaho art; but the symbolic is by far the more developed and noticeable.

LIST OF SPECIMENS FIGURED, CATALOGUE 50.

Fig.	Spec. No.	Fig.	Spec. No.	Fig.	Spec. No.	Fig.	Spec. No.	Fig.	Spec. No.
1	585	30	596	57	614	85	382	112	625
2	708	31	361	58	632	86	648	113	397 A
3	625	32	362	59	296	87	642	114	321
4	381	33	344	60	614	88	397 D	115	301 C
5	344	34	361	61	584	89	96	116	392
6	384	35	596	62	614	90	306	117	660
7	325	36	344	63	392	91	596	118	650
8	642	37	362	64	614	92	688	119	698
9	657	38	361	65	614	93	325	120	397 D
10	305	39	624	67	352	94	397 E	121	397 D
11	305	40	90	68	392	95	370	122	624
12	328	41	390	69	312	96	370	123	296
13	328	42	342	70	305	97	398	124	397 D
14	323	43	625	71	657	98	596	125	391
15	397 D	44	625	72	312	99	596	126	366
16	742	45	352	73	90	100	585	127	390
17	305	46	352	74	642	101	585	128	392
18	327	47	348	75	397 D	102	397 E	129	382
19	370	48	348	76	396	103	642	130	123 A
20	391	49	352	77	299	104	101	131	601
21	101	50	601	78	592 H	105	90	132	328
22	585	51	643	79	382	106	325	133	364
23	350	52	296	80	396	107	381	134	90
24	582	53	382	81	614	108	398	135	382
25	381	54	382	82	370	109	370	136	585
26	325	55	88	83	382	110	299 C	137	659
27	325	56	584	84	27	111	101	138	101
29	398								

Article VIII.—LIST OF BATS COLLECTED BY MR. H. H. SMITH IN THE SANTA MARTA REGION OF COLOMBIA, WITH DESCRIPTIONS OF NEW SPECIES.

By J. A. ALLEN.

This second paper on the collection of mammals made by Mr. Herbert H. Smith in the Santa Marta region of Colombia,[1] presented to the Museum by Mr. Morris K. Jesup, relates exclusively to the Bats, which number about 175 specimens, and are referable to 22 species, of which 3 appear to be hitherto undescribed. Of the species here recorded only 7 are included in the collection made by Mr. W. W. Brown, Jr., for Mr. Outram Bangs, in the same general region.[2] Mr. Bangs's list numbers 10 species, the 3 not yet sent by Mr. Smith being *Vampyrops lineatus* (E. Geoffroy), *Dermanura quadrivittata* Peters, and *Uroderma planirostris* (Spix). In all probability this total of 25 species will be considerably extended by the results of Mr. Smith's further work in this region.

1. **Diphylla ecaudata** *Spix.*—One specimen, Cacagualito (altitude 1500 feet), May 26.

2. **Desmodus rufus** *Wied.*—Sixteen specimens, Bonda, January, March, June, and July—13 adult and 3 juv.

These specimens represent two sharply defined color phases, 9 being in the rufous phase, like the type of *D. rufus* Wied, and 7 in the gray phase, like the type of *D. murinus* Wagner. As there are no appreciable differences between the two series except in color, the natural inference is that the species is dichromatic.

In the rufous phase the color above is dark rufous brown, the hairs basally light yellow; below pale yellowish brown, the hairs uniform from base to tip, the tips slightly silvery. In the gray phase the color above is blackish brown, the basal half of the hairs grayish white; below lustrous silvery gray at the surface, the hairs darker (pale brown) basally.

[1] For the first paper, 'New Rodents from Colombia,' etc., see this Bulletin, Vol. XII, 1899, pp. 195–218.

[2] See Proc. New England Zoological Club, Vol. I, 1899, pp. 100–102.

There are males and females in both series; the males are considerably smaller than the females, the length of the forearm averaging in the males 55 mm. and in the females 60 mm.; metacarpal II in the males, 49 mm., in the females, 53.5 mm.

3. Chiroderma jesupi, sp. nov.

Type, and only specimen, No. 14574, ♂ ad., skin and skull, Cacagualito, Colombia, May, 1898; coll. H. H. Smith.

Similar in skull and teeth to *Chiroderma salvini*, but smaller and with no head stripes.

Above uniform dark brown, the hairs dark brown at base, with a broad median band of ashy white, and tipped broadly with dusky brown; sides and front of neck and upper part of chest grayish brown, the hairs basally and for the greater part of their length grayish white; rest of lower surface pale brown to base of pelage, the tips of the hairs slightly grayish. No head stripes and no dorsal line. Ears small, brown. Interfemoral membrane above well haired to near the posterior border, naked below; wing membrane heavily furred to a line drawn from elbow to knee, as is also the humerus and muscular part of the forearm. Wing membrane from the foot.

The skull is in general similar to that of *C. salvini*, but smaller, with weaker dentition; the middle upper incisors, however, are slender, terete, perfectly erect and parallel, thus differing markedly from the same teeth in *C. salvini* and *C. villosum*.

Measurements.—" Extent, 350"; forearm, 40; thumb, 10; metacarpal II, 36; 3d finger—metacarpal, 39, 1st phalanx, 15, 2d phalanx, 23, 3d phalanx, 19; 4th finger—metacarpal, 33, 1st phalanx, 14, 2d phalanx, 15.5; 5th finger —metacarpal, 38, 1st phalanx, 10, 2d phalanx, 13; tibia, 17; foot, 12; calcaneum, 7. (All the measurements, except the first, are from the dry skin.)

Skull.—Greatest length, 24; breadth of rostrum at canines, 5.2; interorbital breadth, 5.8; breadth behind supraorbital processes, 5.8; zygomatic breadth, 15; mastoid breadth, 11.6; median length of bony palate, 9.6; width of same between last molars, 5.6; length of upper toothrow (exclusive of incisors), 6.7; mandible, 15; lower toothrow, 7.5.

The slender, erect, parallel middle upper incisors serve at once to distinguish this species from any of its described allies.

Named in honor of Morris K. Jesup, President of the American Museum of Natural History, to whom the Museum is indebted for the very large collection of Colombian mammals of which the present fine series of bats forms a part.

4. **Vampyrops vittatus** (*Peters*).—Two specimens, Valparaiso (altitude 4500 feet), April 29 and June 10. Sex not indicated.

The collector's measurements are: Extent, 480 and 484; length, 95 and 100; length of wing (from carpal joint), 134 and 137.

5. **Uroderma bilobatum** *Peters.*—Fourteen specimens, as follows: Bonda, 11, May 24–June 4; Cacagualito, 2, May 14 and 25; Minca, 1, July 9.

6. Artibeus palmarum *Allen & Chapman.*

Artibeus femurvillosum BANGS, Proc. New Engl. Zoöl. Club, I, 73, Nov. 24, 1899. La Concepcion, Colombia.

Three specimens, Bonda, May 24 and August 29. "Extent, 506; length, 115; wing (from carpal joint), 155 mm." (collector's measurements).

These specimens and two from Cali, western Colombia (J. H. Batty), do not appear to differ from Trinidad examples, to which *A. femurvillosum* Bangs is also referable.

7. **Glossophaga soricina** (*Pallas*).—Six specimens, Bonda, February, June, and July.

8. **Glossophaga longirostris** *Miller.*—Thirty-four specimens, of which 28 are from Taguaga, from "a cave on the seashore," June 22 and 23, and 3 from Bonda, March, June, and November. One of the specimens from Taguaga is labelled, "contained a full-grown fœtus."

This species was described by Mr. Miller (Proc. Acad. Nat Sci. Phila., 1898, p. 330) from a single specimen in the Bangs collection, taken in the "Santa Marta Mountains (near Santa Marta), Colombia, February 10, 1898." It is well distinguished by its large size and dark coloration, and is perfectly distinct from *G. soricina* from near-by localities. Mr. Miller's specimen lacked all of the incisors. He says: "Distinct traces of the alveoli can still be seen in the mandible, but these are nearly obliterated in the upper jaw. Whether this condition is normal, as in the genus *Lichonycteris*, it is, of course, impossible to say." In nearly one-half of the present series of 34 specimens the incisors are all present in both jaws; in about one-third of the series they are entirely absent in both jaws; in the remainder some of the incisors are present and the alveoli of those lacking

are clearly indicated. Apparently they are absent, as a rule, only in old specimens.

As noted above, all of the specimens except three were taken from caves at Taguaga, on the seashore. As this series contained no specimens of *G. soricina*, apparently the two species are not intimately associated in life, though examples of both were taken at Bonda, near Taguaga.

9. **Hemiderma brevicauda** (*Wied*).—Fourteen specimens, Bonda, April 27 and June 14.

10. **Phyllostoma hastatum** (*Pallas*).—One specimen, in alcohol, from Bonda, May, 1898. This is a very large and very old individual, the teeth being greatly worn.

11. **Trachops cirrhosus** (*Spix*).—One specimen, Bonda, June 12.

12. **Micronycteris megalotis** (*Gray*).—Thirteen specimens, Bonda, May 26, June 13–20, August 8, and November 20.

13. Micronycteris hypoleuca, sp. nov.

Type, No. 15131, ♀ ad. (skin without skull), Bonda, July 9, 1899; coll. H. H. Smith.

About the size of *M. minuta*, but white below instead of ashy, and the basal portion of the pelage above white instead of ashy white.

General color above dark reddish brown, the basal half of the pelage white with a faint tinge of yellowish; below white to the base of the pelage, with a faint yellowish tinge, the hairs posteriorly on the sides faintly ashy brown subterminally; colors of dorsal and ventral surfaces sharply defined. Ears brown, furred about as in *M. megalotis*; proximal fourth of forearm above covered with short fur. Forearm long in proportion to the rest of the wing, the forearm about equalling the length of the forearm in *M. megalotis*, while the third finger is much shorter than in that species. Foot long and narrow, much longer than in *M. megalotis*, although the latter is a much larger species.

Measurements.—"Total length to end of tail, 60"[1]; ear, 14; nose leaf, 3.5 x 5.5; forearm, 33; thumb, 8; third finger—metacarpal, 27, 1st phalanx, 11, 2d phalanx, 12, 3d phalanx, 9; fourth finger—metacarpal, 28, 1st phalanx, 9, 2d phalanx, 9; fifth finger—metacarpal, 28.5, 1st phalanx, 10, 2d phalanx, 8; tibia, 20; foot, 11; calcaneum, 8.

This species resembles *Schizostoma minuta* Gervais (Expéd. du Compte de Castelnau, Zool., I, 1855, Mamm., p. 50, pl. vii, fig.

[1] Collector's measurement from the fresh specimen; rest of measurements from the dry skin.

1, and pl. x, fig. 5), apparently agreeing with it in size, but differing from it in coloration. The type of *M. minuta* was from "Capella-Nova, dans le Brésil," on the upper Amazon, but a second specimen, still darker in color, from the Province of Bahia, was also referred to it by Gervais.

The single specimen on which *M. hypoleuca* is based unfortunately lacks the skull. It differs from descriptions of *M. minuta* by Gervais and Dobson in the yellowish white instead of grayish white underfur above, and in the clear white instead of ashy underparts.

14. **Chrotopterus auritus** *Peters.* — One specimen, ♀, Bonda, June 5. "Extent, 392; length, 95; wing (from carpal joint), 110."

15. **Dolichophyllum macrophyllum** (*Wied*).—One specimen, ♂, Bonda, July 9. "Extent, 335; length, 90; wing (from carpal joint), 85."

16. **Promops affinis**, sp. nov.

Type, No. 15109, ♀ ad., skin without skull, Taguaga, June 23, 1899; coll. H. H. Smith.

Size and general appearance of *Promops depressus* (Ward) from northern Mexico, but membranes and general coloration much darker, with heavier dentition and differently shaped ears.

Adult.—Above dark rufous brown, with the basal portion of the fur clear fulvous white; below similar but somewhat paler. Ears and membranes blackish brown.

Juv.—Above blackish brown, extreme base of hairs ashy; below sooty brown, the hairs ashy at extreme base and with the tips faintly ashy; ears and membranes black.

Measurements.—"Expanse, 423; total length, 136; wing from carpus, 111"; tail, 68, free portion of tail, 34; forearm, 60; thumb, 10; metacarpal II, 56; 3d finger—metacarpal, 59, 1st phalanx, 23, 2d phalanx, 21; 4th finger—metacarpal, 57, 1st phalanx, 20, 2d phalanx, 3; 5th finger—metacarpal, 27, 1st phalanx, 19, 2d phalanx, 5; tibia, 18; foot, 11.

This species is based on six specimens, only one of which (taken as the type) is adult, and this unfortunately lacks the skull. Although the immature examples almost equal the adults in size (the forearm ranging from 54 to 56 against 60 in the adult), four out of the five still retain the upper milk incisors.

These are slender, curved teeth, two on either side, obliquely inserted, with the tip strongly curved laterad. As the permanent incisors are already well developed, there are thus six upper incisors, arranged in two rows, an outer row of four milk incisors and an inner row of two permanent incisors.

The skull of *Promops affinis*, allowing for the immaturity of the specimens, closely resembles, in general form and character of the teeth, that of *P. depressus* (Ward) from Mexico. The two species are also practically of the same size and proportions, but in color *P. affinis* is much darker than *P. depressus*, and has the lower outer lobe of the ear much narrower, and the inflated upper internal border wider. They are obviously closely related forms, but their exact relationship can be determined only on comparison of a larger amount of more strictly comparable material.

A note by the collector attached to one of the specimens states: "This species congregates in narrow fissures of the coast rocks, just above the surf. When disturbed it crawls deeper into the crevices, but does not take flight (in the daytime) even when a gun is fired into its retreat."

I take the present opportunity to record what seems to be another undescribed species of *Promops*, from Peru, received a few years since from Mr. O. T. Baron, and hitherto wrongly identified.

Promops milleri, sp. nov.

Molossus nasutus Allen, Bull. Am. Mus. Nat. Hist. IX, 1897, 115. (Not *M. nasutus* of Spix.)

Type, No. [illegible], ♀ ad., Guayabamba, Peru (altitude 6000 feet), September 24, 1894; O. T. Baron.

Pelage very soft and thick, moderately long. Above dark sooty brown, hairs pale fulvous at extreme base; below similar but rather paler; ears and membranes black. Distribution of fur on the wing membrane, on the forearm, and between the fingers, much more restricted than in *Molossus rufus* or *P. abrasus*, and the naked margin of the outer surface of the ears is much broader. Ears moderate for a *Promops*, nearly meeting in front but not joined; tragus small, pointed, broadest at base. Tail extending about half its length beyond the membrane.

Measurements.—Collector's measurements from four fresh specimens: Head and body, 81; tail, 46; hind foot, 15–16. Measurements of type, from skin:

Forearm, 57; thumb, 11; metacarpal II, 55; third finger—metacarpal, 59, 1st phalanx, 25, 2d phalanx, 20; fourth finger—metacarpal, 57, 1st phalanx, 21, 2d phalanx, 19; fifth finger—metacarpal, 31, 1st phalanx, 18, 2d phalanx, 5; tibia, 18; foot, 13; breadth across ears, 27.5.

Skull.—The skull is massive, and the teeth are broad and heavy; rostral portion of the skull much broader than the interorbital. The upper canine is in strong contact with pm.^{2} so that the very small pm.^{1} stands on the outer edge of the toothrow. The upper incisors are strongly curved and arch forward, projecting much beyond the canines.

Total length, 23.5; basal length, 20; breadth of rostrum at base of canines, 6; greatest breadth of rostrum, 7.5; least interorbital breadth, 5; zygomatic breadth, 14; mastoid breadth, 12.5; palatal length, 10; distance between last molars, 5; upper toothrow (exclusive of incisors), 9.5; mandible, 18; lower toothrow (exclusive of incisors), 10.

Promops milleri is based on four adult females, all remarkably uniform in size and coloration, from Guayabamba, Peru, collected September 24, 1894, by Mr. O. T. Baron. They were at first referred to *Promops nasutus* (Spix), and I am indebted to Mr. Gerrit S. Miller, Jr., after whom the species is named, for calling my attention to its probable distinctness from this, apparently its nearest ally. It differs from this species in its much larger size, in the much lesser development of the furred areas on the forearm and wing membranes, in the form of the tragus, in the greater length of the exposed portion of the tail, and in the form of pm.$\overline{2}$, which is not higher than pm. $\overline{1}$. *P. milleri* is of about the size of *P. abrasus* (auct.), but differs from it greatly through the less extension of the fur upon the proximal border of the wing membrane, in coloration, character of the tail, etc.

17. **Peropteryx canina** (*Wied*).—Five skins and three specimens in alcohol, Bonda, June and August.

18. **Saccopteryx bilineata** (*Temm.*).—Thirty-six specimens, 28 skins with skulls and 8 in alcohol: Bonda, 33, February, April, May, June, July, August, and September; Minca, 3, July and August.

This series represents two well-marked color phases, a black and a brown. In the black phase the color above is often black, more commonly deep brown black; below blackish brown, washed with ash gray. In the brown phase the color above is dark rusty brown; below pale brown, the tips of the hairs lighter.

A few specimens are practically intermediate and to some extent connect the two phases.

The white markings on the back vary much in distinctness in different specimens, being sometimes almost clear white and strongly defined, in other specimens brownish white, and sometimes obsolete.

There are seven young, two of which are very young and the others about two-thirds grown. These are nearly uniform blackish plumbeous above, somewhat lighter below, with the hairs slightly ashy-tipped.

19. **Saccopteryx leptura** (*Schreber*).—Two skins and three specimens in alcohol, Bonda, March, April, and June.

20. **Thyroptera tricolor** *Spix.*—One skin, without skull, Cacagualito, May 24.

21. **Myotis nigricans** (*Wied*).—Nine specimens, Bonda, June 14, July 24, August 14, and September 5. Three of the specimens are paler and browner than the others, but they apparently represent only a brownish phase of *M. nigricans*, as they do not differ appreciably from the others except in color.

22. **Lasiurus pallescens** (*Peters*).—One specimen, Bonda, July 6.

This is slightly smaller than Dr. Peters's type, from the "Andes de Merida" of western Venezuela, but apparently not otherwise different.

Calcite Crystals

From Joplin, Missouri

Article IX.—NOTE ON AN INTERESTING SPECIMEN OF CALCITE FROM JOPLIN, MISSOURI.

By L. P. Gratacap.

Plate VI.

An interesting specimen of Calcite was recently added to the mineral cabinet of the Museum, which from one apparently novel feature, observed in it, merits description. The specimen is from Joplin, Missouri, and presents an irregular surface covered with pale-colored, quite indiscriminately related crystals, amongst which a few larger and darker-colored individuals are conspicuous. The calcite is associated with Marcasite and has apparently crystallized along the walls of a crevice in pyritous calcareous clay. Its formation is secondary to the iron sulphide which it covers. The carbonate of lime is pure, a scarcely perceptible residue being observed upon solution, so that the angles in the forms are normal. No orientation in the disposition of the crystals occurs, and the augmentation in color, a light straw tint, is proportional to the increase in the size of the crystals.

The crystals are combinations of two rhombohedrons—obtuse

Fig. 1

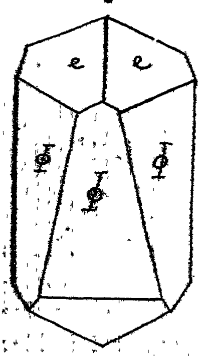


Fig. 2

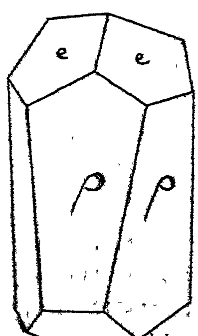
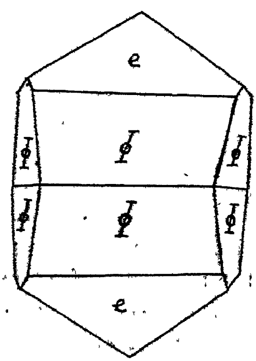


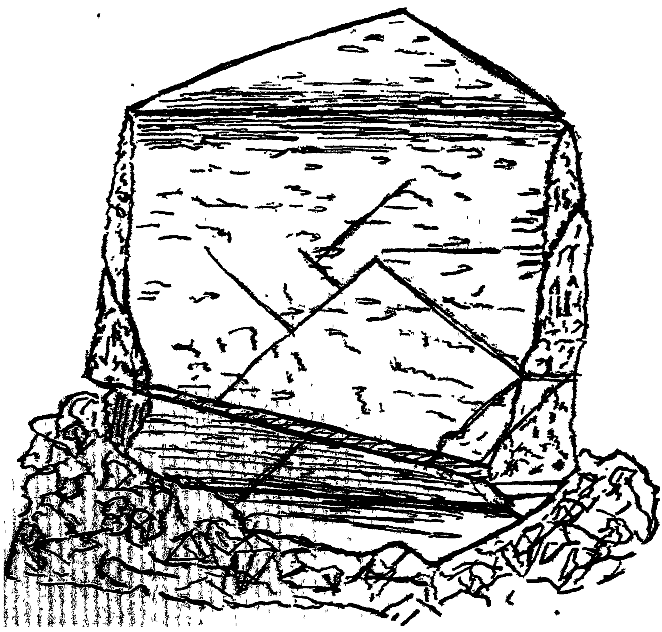
Fig. 4



and acute—modified in the larger individuals by the incipient development of scalenohedral faces. Also in the large crystals the alternate faces of the acute rhombohedrons are unequally de-

veloped, and in two instances an interpenetration of two individuals occurs, producing a twinning, by the revolution, through 60°, of one. Blistered, roughened, and curved surfaces appear conspicuously in the large crystals. The outlines of the smaller crystals seem deceptively sharper, from the diminution of these irregularities in actual development.

Fig. 3



The apparent crystallographic novelty in this specimen lies in the relation of the two rhombohedrons. The negative low rhombohedron—e ($01\bar{1}2$, $-\frac{1}{2}R$)—is superimposed upon the negative acute rhombohedron—Φ ($0.14.\bar{14}.1$, $-14R$)—whereby the wider ends of the faces of Φ intersect e in a straight edge, and the narrower the same low rhombohedron in a V-shaped outline. The usual association, and that generally figured, is the negative rhombohedron e ($01\bar{1}2$, $-\frac{1}{2}R$) with the positive rhombohedron

ρ (16.0.16.1, $+ \bar{16}$ R) whereby a precisely reversed position of the faces obtains. Fig. 1 represents the relation in the Joplin specimen, and Fig. 2 that commonly recognized. In other words, the ordinal positions of the rhombohedrons are unified, the acute rhombohedron, usually of a different order from the terminal low rhombohedron, itself negative, has become also negative by revolution, and is now coördinate with the apical termination of the crystal.

The identity of the acute rhombohedron is doubtful, as the angles cannot be measured with accuracy either by hand or reflecting goniometers. The negative form of Φ is figured by Haüy in his Traité de Mineralogie (Atlas, Pl. VII, fig. 34), 1823. The negative form of ρ has not, as far as I know, been observed, and in the necessarily doubtful measurements of these roughened surfaces, an error of observation of 7′ (being the angular difference between $\rho\rho'$ and $\Phi\Phi'$) is negligible.

The negative order of the low rhombohedron is demonstrated by the cleavage lines parallel to $\frac{1}{2}$ R. A drawing of the natural size and proportions of one of the interpenetration twins is given in fig. 3, and in fig. 4 its ideal form. The blistered, creased, wrinkled, and pustulate surfaces seem to arise from repeated interferences in the growth of the crystal, and in places seem also referable to partial solution. Plate VI shows the entire group, two thirds its natural size.

The recent interest in Joplin forms, awakened by Dr. Farrington's treatise[1] on these attractive crystals, excuses this slight contribution to their discussion.

[1] Crystal Forms of Calcite from Joplin, Missouri. Field Columbian Museum, Publication 44; Geological Series, Vol. I, No. 7.

Article X.—A SHELL GORGET FROM THE HUASTECA, MEXICO.

By Marshall H. Saville.

In a recent paper Dr. Frederick Starr has described and figured an engraved shell gorget from the State of Michoacan, Mexico, the first specimen of this character which has heretofore come to our notice. It is from the region of Tarascan culture. The general resemblance of this object to specimens of a somewhat similar nature from Tennessee, Missouri, and Georgia is commented upon by Dr. Starr, to whose article the reader is referred.[1]

In the collection of the American Museum of Natural History is another shell gorget, from the vicinity of Tuxpan, State of Vera Cruz, Mexico, in the region of the Huastecans, a branch of the Maya stock of Yucatan and Central America. This specimen was found during the winter of 1899–1900, and it is here figured and described on account of its resemblance to the representations of deities to be found in the Mayan codices.

Not much is known, archæologically, of that part of the State of Vera Cruz between Tuxpan on the south and Tampico at the mouth of the Rio Panuco on the north, which is still occupied by Huastecan Indians.[2] According to Orozco y Berra, Huaxtecapam formerly extended from what is now Vera Cruz to San Luis Potosi in the interior and northward along the coast probably well into the State of Tamaulipas, in places where at present no vestiges (linguistic) remain.[3]

The shell gorget now to be described (See Fig. 1) is cut from a *Busycon perversum* and is a thin, concavo-convex plate. About one quarter of the specimen is broken off and missing. The inner concave face is the one carved. The outer convex surface is smooth save for numerous small pits. It measures 68 mm. in height and 58 mm. in breadth and 1 to 2 mm. in thickness.

[1] 'A Shell Gorget from Mexico,' by Frederick Starr, Ph.D. Reprinted from the Proceedings of the Davenport Academy of Sciences, Davenport, 1896, pp. 173–178.

[2] Marcelo Alejandre in his 'Cartilla Huasteca,' published by the Mexican Government in 1889, under the head of antiquities states that nothing remains of the ancient Huastecan civilization except a few stone figures. Only the ruins of old cities exist.

[3] 'Geografia de las Lenguas y Carta Etnografica de Mexico,' Mexico, 1864, p. 206.

A narrow plain band around the edge of the disk surrounds the central carving which represents a seated human figure. It faces the left as in the Mayan codices, where glyphs, and human figures representing deities singly or in procession, are found facing the left. The only exception is where two deities face each other while engaged in some priestly function. This figure

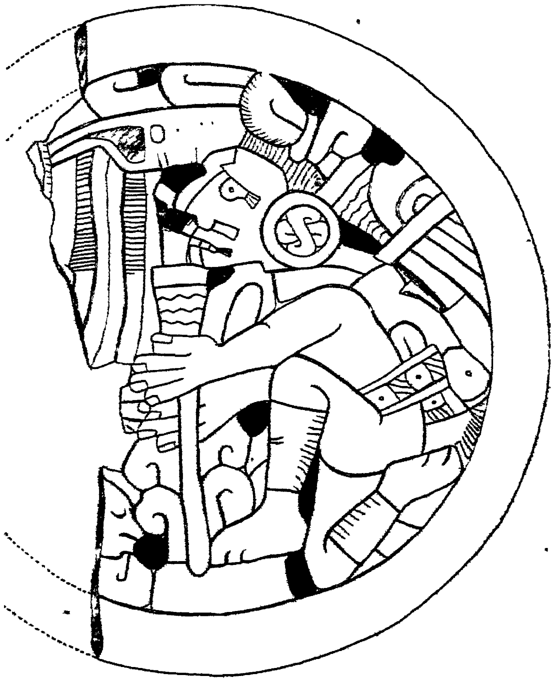


Fig. 1.

in the gorget is seated on the upturned foot of the right leg, which is bent under the body. The left leg is bent, the foot pressed on a rectangular piece of wood. The head is slightly raised; the expression of the face is serious. A complicated headdress surmounts the head, resting on the hair. This headdress somewhat resembles those seen on a certain deity of the Mayan codices. The eye is drawn in a conventional manner and is connected with a zigzag line which runs from the top of the forehead down

over the nose to the base. A line is also seen on the upper lip, and chin, and seems to be indicative of a mask. The upper lip projects outward over the lower, and teeth are only represented in the upper jaw. A few lines are connected with the back of the mouth, and this is also a feature of the eye.

The nose is decorated by a long squared stick placed through the septum at the base. Covering the ear is a large circular ornament on which is carved a Swastika cross surrounded by a plain band. Some indication of a neck decoration is seen on the chest, and on the back is a sort of garment hanging to the waist. Around the waist is a belt which appears to be knotted behind. This is the loin cloth or *maxtli*. It bears a decoration which will be referred to later. The legs are covered between the knees and ankles. The arms are stretched out in front of the body; the elbow of the left arm rests on the left knee. The right hand is lower than the left, and between the palms is a stick which is being twirled in a hole in the block of wood under the left foot. Rising from the hole is the representation of smoke. This stick is somewhat larger at the top than at the base, which is pointed, and the part above the hands bears parallel zigzag lines running transversely to the length of the stick. Opposite the block is what appears to be the head of a monkey, the body being in the part of the gorget which is missing. The black spots in the illustration are apertures (ten in number) cut through the shell from the outer convex side and appear to have been made by drilling.

Fig. 2.

We will now compare this specimen with representations of what seems to be an analogous deity in the codices of the Mayas of Yucatan and Central America. In figure 2 is reproduced a seated figure from page xix of the Codex Troano. The line on the face differs somewhat from that on our gorget. In the codices, in this deity it invariably extends from the top of the forehead to the base of the chin, interrupted by the eye. In some instances, as in the Codex Cortesianus, the face is painted

brown, blue, or black in front of the line; again it is painted blue back of the line, while in the majority of cases the face is not painted. It is an ever present and characteristic feature of the Maize God of the Mayas, to which Brinton has given the name *Ghanan*, God of Growth and Fertility.[1] This line may be seen in the specimen described by. Starr, but it is not noted by him. In figure 2 the Maize God is seated with the legs bent in front of the body, elbows resting on the knees. In the headdress a certain resemblance may be traced with that of our gorget. In the hand is held a stick, the lower end placed in a hole in a round object. Whether this is a fire stick it is impossible to affirm with

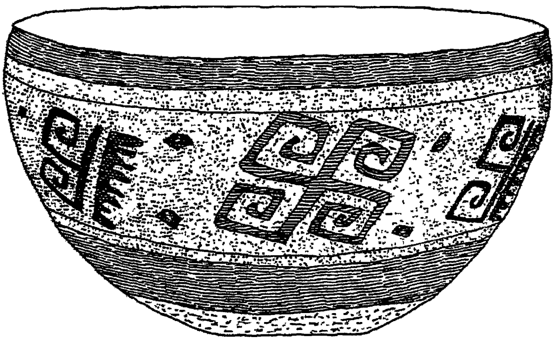


Fig. 3.

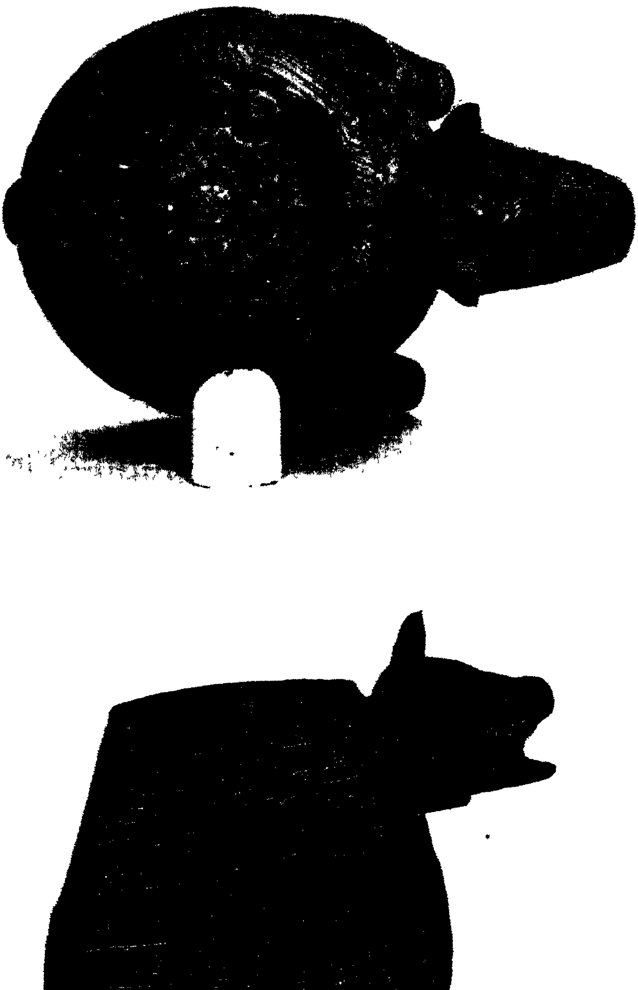
certainty, as no smoke is represented in the drawing. There is, however, a red spot near the hole which probably represents fire. Around the waist is a belt decorated in much the same manner as in the gorget. This belt decoration is nearly always seen in the Maize God figures, and rarely elsewhere in the Mayan codices. In the Nahuatl codices no deities of a like character are found.

An exceedingly interesting feature is the Swastika on the ear ornament. This symbol is excessively rare in Mexico, but four other examples are known to the writer, one of which is in the collections of the American Museum of Natural History. As it has never been published it is now given in figure 3. It is a

[1] 'Primer of Mayan Hieroglyphics,' p. 62.
Dr. Schellhas in his 'Die Göttergestalten der Mayashandschriften,' 2d edition, pp. 19–20, calls the Maize God, or God E.

bowl of the Cholula type of pottery and comes from Tepeaca, State of Puebla, in the territory of Nahuatl culture. This bowl is 73 mm. high and 146 mm. in diameter at the rim. It is painted dark red, with an orange-colored band just below the rim, upon which is a series of Swastikas in red, alternating with a half Swastika and a comb-like ornament in black. In the private collection of Carlos Baur, Puebla, is a similar bowl, with the Swastika decoration, from Cholula. Another Swastika is the calendar reproduced on Plate I, Trat. 3, atlas of 'History de la Nueva España,' by Fray Diego Duran. The original painting is in a codex of the Goupil collection in the National Library of Paris. Finally Dr. Le Plongeon figures a reversed Swastika found by him on a stone slab at Mayapan, Yucatan.

In conclusion, there seems to have been a high state of culture among the Huastecans, as seen in this beautiful carving, and a near relationship with the Mayan mythology, which is indicated by the close resemblances noted between this figure and those of the codices.



ONYX JAR FROM MEXICO. TOP AND SIDE VIEWS ($\frac{30}{7486}$).

Three-eighths natural size.

Article XI.—AN ONYX JAR FROM MEXICO, IN PROCESS OF MANUFACTURE.

By M. H. Saville.

Plate VII.

In making vessels from stone the ancient Mexicans had attained a high degee of proficiency, judging from the few specimens which have been preserved in museums and private collections. The most remarkable are those made from obsidian and onyx. The best examples are in the National Museum in the City of Mexico. They are sometimes plain, unadorned cups, but more often have the representation of an animal, with the head and limbs standing out from the body of the vessel. A notable piece in the National Museum in Mexico is made of obsidian, brilliantly polished, and represents a monkey, crouching, with its arms hanging to a hoop which is carved around the rim of the vessel. There is in the same museum an unfinished vessel carved out of onyx. It is hollowed out, and the outside is completed with the exception of polishing. It represents an animal similar to that on the one here described and figured belonging to our collection. These vessels are hollowed out of a solid mass, leaving their walls of varying thickness, but about 5 mm. on an average around the sides. They are in most cases well finished and highly polished.

During the exploration of mounds and tombs at Xoxo, in the State of Oaxaca, which I made in March and April, 1898, for the Museum, I found the fragments of an onyx jar 135 mm. in height and 115 mm. in diameter, the thickness of which averaged 5 mm. The surface had been coated with stucco ; and the remains of red, blue, and green paint showed that it had been decorated with paintings, probably symbolic figures. In the famous Sologüren collection in the city of Oaxaca are several fine specimens, and one, of a decidedly green onyx, in process of manufacture. A specimen, belonging to the American Museum of Natural History, was found several years ago near the city of Tlaxcala, State of Tlaxcala, and is a relic of Nahuatl art. It is blocked out and symmetrically shaped, and is 160 mm. high, 145 mm. in

diameter at the base, 95 mm. at the rim, and 485 mm. circumference at the centre. The maker cut the stone so as to leave the head of an animal, probably a dog or coyote, projecting from one side, just below the rim, with the limbs in low relief on the sides, showing the animal resting on its haunches. The lower part and feet project from the base of the vessel. The tail curves upwards from the base of the vessel. The four feet and the tail of the animal thus make five slight projections around the base of the vessel, 4 mm. in height, on which it rests. The toes on the feet of the animal had not been carved; nor had the teeth, eyes, or openings of the ears and nose. The surface of the stone is somewhat disintegrated, so that the irregular striation of the stone, where the softer material has decomposed, gives a series of ridges running parallel with the base of the jar.

The most interesting feature of this specimen is the way in which the interior was being hollowed out, which is clearly shown, and indicates the abandonment of the work at an early stage in the process of manufacture. The method employed was drilling, probably with a bow- or pump-drill, the shaft of which was a hollow *otlati*, the common reed found generally in Mexico. A series of cores averaging 9 mm. in diameter were drilled around the inner edge, leaving a scalloped rim varying from 3.5 to 9.5 mm. in thickness, and an average diameter of the inner wall of the jar of 81 mm. These cores, thirteen in number, have been broken off with the exception of two, and at varying depths, 34 mm. being the greatest, while four of the cores were broken off at a depth of only 10 mm. The thickness of the walls of the hollow drill, as indicated by the spaces left, must have been about 2 mm. These outer cores being removed left a large inner scalloped core in the centre, about 42 mm. in diameter, and three cores were made across it with a smaller drill, they being but 7 mm. in diameter and 8 mm. in depth. Had the work been carried on, this would have left two walls which could have been easily broken off, leaving the first stage of the work complete, and ready for repeating the process below, until the whole mass had been hollowed out.

An interesting onyx tablet from the Valley of Mexico is described and figured by Prof. W. H. Holmes in his 'Archæological Studies among the Ancient Cities of Mexico,' Part II, pp.

304–309. In this specimen the use of a hollow drill is shown. When it was received in the Field Columbian Museum, Chicago, it was found broken in two pieces, and an examination of the smaller fragment revealed the end of a tubular bone projecting from the opening of the longitudinal perforation. I quote from the author's description the following: "The hollow bone, probably from the leg of a crane or other large bird, is 2¾ inches long and ⅜ of an inch in diameter. It is shattered and worn at the upper end, while the lower end or point has the appearance of having been freshly cut off. . . . On cleaning out the earth (from the perforation) the fact was developed that the borings from opposite ends of the tablet had not met accurately, and the conclusion was at once reached that the drill was probably being employed, when the work ceased, to enlarge the bore with the intention of making more complete the connection from end to end.

"The use of the tubular drill of cane, bone, or native metal by primitive peoples, and even by many well advanced nations is well known. The tube was twirled by rolling between the hands, or by a pump- or bow-drill, and sand of suitable fineness and hardness was employed as a cutting agent. That a tubular drill was used in the present case is proved by the presence of a well developed core at the base of the boring from the upper end."

Sahagun does not tell us how drilling was done by the ancient Mexicans, but states that they polished hard stones by means of a bamboo.[1] This is undoubtedly the way in which the high polish was obtained on the vases of obsidian and onyx to which I have referred at the beginning of this paper.

The use of a reed or bone for a hollow drill was common in other parts of North America, as shown by unfinished gorgets and banner stones in various collections.

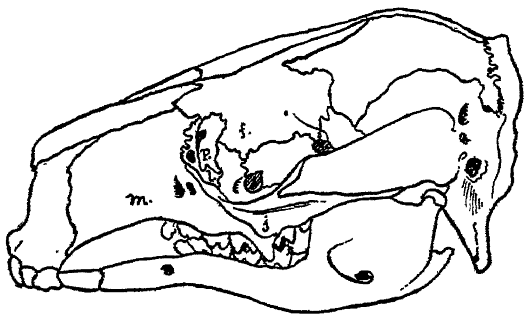
[1] In the Bustamente edition of Sahagun's great work on the 'Things of New Spain,' the chapter on Stone-working is missing. Dr. Seler has published this chapter, giving the original Nahuatl text and a translation into French in the Compte Rendu du Congrès International des Americanistes, Paris, 1890.

Article XII.—A CRANIAL VARIATION IN MACROPUS BENNETTI.

By B. ARTHUR BENSLEY, Senff Fellow, Columbia University, New York.

While examining a series of Marsupial skulls in the American Museum of Natural History my attention has been attracted to a skull of a Bennett's Wallaby which possesses a supernumerary bone in the anterior wall of each orbit. Professor Allen kindly loaned the skull (No. 6370) for description.

The accompanying diagram, which is taken from a photograph, represents the lateral aspect of the skull viewed slightly from above. Only the outline of the skull, the sutures, and the foramina are indicated. It will be seen from this diagram that the anterior orbital bones exhibit an atypical arrangement, which is brought about by the interposition of a supernumerary bone. The presence of the latter is seen to affect mainly the relations of the lachrymal bone, the other sutural connections in this region of the skull remaining normal. The lachrymal (l.) exhibits its usual relations with reference to the maxillary (m.) and jugal (j.) but is excluded from its usual contact with the frontal (f.), and to such an extent that only a very small portion of its upper border retains the frontal connection. This condition is entirely the result of the presence of the superadded bone, which forms a flattened plate closely set into the lachrymo-frontal suture. The supernumerary bone, as far as can be ascertained, is entirely separate; it does not appear to represent simply a portion of the lachrymal or of any other of the adjacent bones. On account of its encroachment, the lachrymal appears to be less extensive than it usually is, although it is impossible, from superficial examination,



to decide whether the lachrymal terminates at its posterior superficial suture or extends backwards underneath the supernumerary bone to connect with the frontal. Of the two foramina normally perforating the lachrymal, only one is in this case enclosed by it, the other occupying its posterior suture. The relations of the other cranial bones appear to be normal.

It is difficult, in this, as in most such cases, to decide as to what category of characters the atypical condition pertains. There are three possibilities,— the character may be simply the result of accident, or the result of abnormal development, or, again, it may be reversional. The fact that the supernumerary bone is present on both sides of the skull and that it bears similar relations to the adjacent bones seems to preclude the possibility of regarding the character as the result of injury done to the parts concerned. If, again, the suture between the lachrymal and the supernumerary bone were obliterated, the resultant bone would exhibit the typical relations of the lachrymal in this species, so that the supernumerary bone may represent simply a post-lachrymal structure of no morphological significance. On the other hand, it resembles, in its position, the prefrontal of the lower Vertebrata and might, on this account, be interpreted as homologous with it, in which case the condition would have to be regarded as reversional.

Article XIII.—A NEW SPECIES OF PLEISTOCENE HORSE FROM THE STAKED PLAINS OF TEXAS.

By J. W. GIDLEY.

Equus scotti, sp. nov.

The type of this species is a nearly complete skeleton (No. 10606), consisting of the skull and lower jaws, the cervical vertebræ, the three anterior dorsal vertebræ, both fore limbs and feet complete, and one hind limb and foot, besides several other vertebræ and some ribs probably belonging with it.

This skeleton was found by the writer associated with four other skulls and parts of skeletons of the same species, in a bed of compact Pleistocene sand at the head of Rock Creek, Briscoe Co., Texas. The bed in which the bones were found is about the middle of the Equus, or Sheridan, beds, which are about 100 feet in thickness at this place.

Bones from the associated individuals have been substituted for the missing bones of the skeleton (No. 10606) which has been admirably mounted by Mr. Adam Hermann, and placed on exhibition in the Tertiary Mammal Hall of the Museum.

The writer has made a very careful study of all the types of the species of *Equus* in this country and has found that an extensive revision is necessary; this will be published in a subsequent paper. It appears that the horse from the true Equus beds of the Plains has not been taken as a type but has been mistakenly identified with other species. A new term is therefore necessary and this is selected in honor of Prof. W. B. Scott, of Princeton University.

The species *E. scotti* differs from *E. caballus* in proportions and size as follows: (1) the skull is relatively larger, (2) the neck is shorter, (3) the body is longer, (4) the lesser curvature of the belly ribs near their heads indicates that the back was not nearly so wide, (5) the limbs are shorter and more slender in proportion than the larger varieties of the recent horse.

Comparing the skeleton of *E. scotti* with the skeleton of a larger draught horse (No. 528) in the osteological collection of

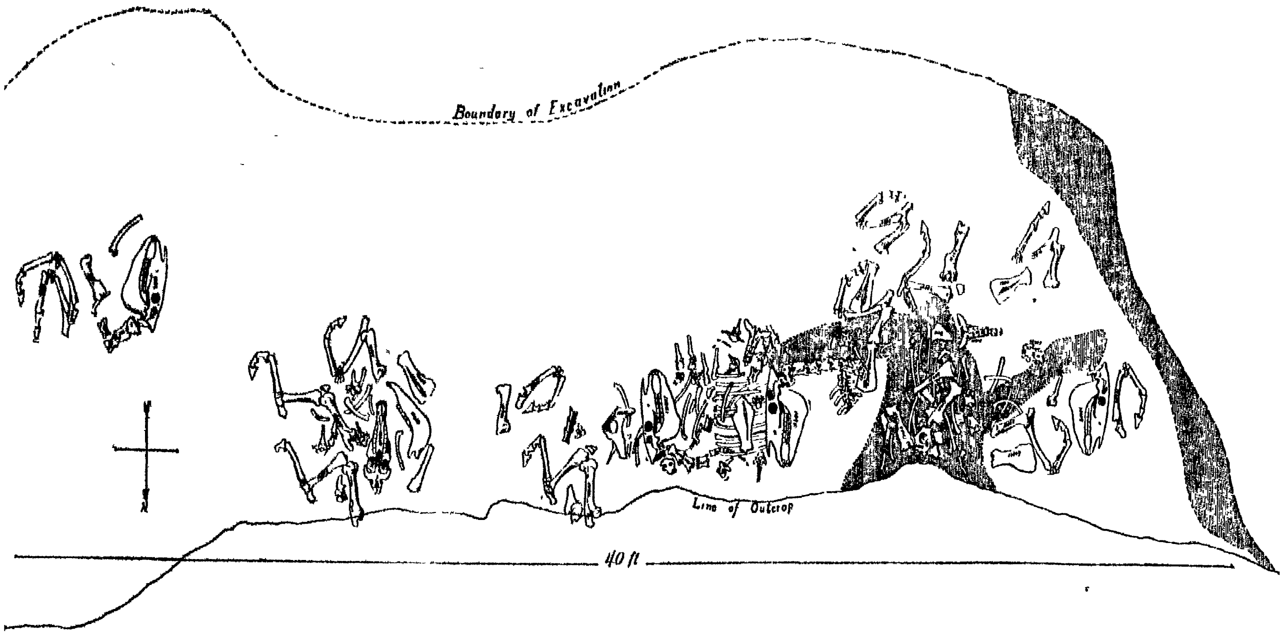


Fig. 1. Sketch showing number and position of remains of *E. scotti*.

the Museum we observe some striking differences. While the skulls are about equal in length and the series of dorso-lumbar vertebræ is only about 1 inch longer in the recent horse, the cervical series of *E. scotti* is about 4 inches shorter and the fore limb, in the standing position, is about 6 inches less in length.

Thus, this skeleton represents an animal with a head about the size of that of a large draught horse, but with the height of body and length of limbs of an ordinary western pony, and with a length of body very similar to that of the Zebra or Quagga.

A comparison of the separate bones of the skeleton reveals very few and unimportant differences, hence it is to the skull and teeth that we have to look for specific differences.

DENTITION.

Unfortunately all the bones of these skeletons, while adult, are of young horses, none of them having shed their last milk molars or external milk incisors. As far as can be made out the teeth differ from those of *E. caballus* only in their much larger size. M^1 of the type skull (Fig. 2), indicates perhaps a little greater degree of complexity of the enamel folding on the triturating surface than is usual in *E. caballus*, but it should be taken into account that this is only a slightly worn tooth and shows a greater degree of complexity than it would at a more advanced stage of wear.

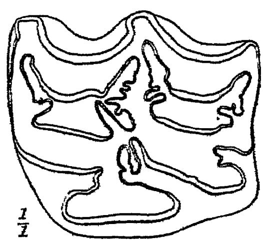


Fig. 2. M^1 of *E. scotti.*

The measurements of the teeth that are enough worn to give their true diameters are as follows :

Diameters of crown of p^3	antero-posterior	33 mm.
	transverse	31 mm.
Diameters of crown of m^1	antero-posterior	32 mm.
	transverse	30 mm.
Long diameter of i^1		23 mm.
Total length of molar-premolar series		190 mm.

Diameters of the corresponding teeth of the large draught horse (No. 528):

Diameters of crown of p^3	antero-posterior	29 mm.
	transverse	27 mm.

Diameters of crown of m^1	antero-posterior	25 mm.
	transverse	25.5 mm.
Long diameter of i^1		18 mm.
Total length of molar-premolar series		172 mm.

Thus it is seen that while the skulls of these individuals representing two species are of about the same size, the teeth of

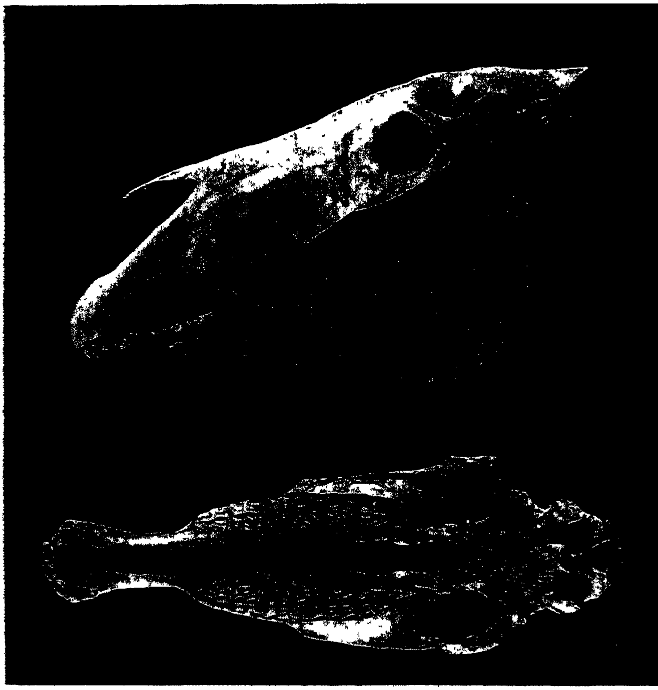


Fig. 3. Skull of *E. scotti.*

E. scotti (Fig. 3) are much larger and the whole masticating apparatus is proportionately shorter and better adapted to grazing than in *E. caballus* (Fig. 4); although the proportion of teeth to skull is not much greater than in the pony. The teeth seem to differ from *E. eous* Hay,[1] a species from Louisiana described by Cope under the name of *E. intermedius*,[2] only in their somewhat larger size.

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[1] Science, 1899, p. 593.
[2] Proc. Am. Phil. Soc., Vol. XXXIV, p. 463.

COMPARISON WITH E. CABALLUS.

The nose of *E. scotti*, from the anterior premolar forward, is as much elongated as in *E. caballus* and in this character it differs entirely from *E. eous* which has a very much shortened nose. To make up apparently for the longer molar-premolar series, the

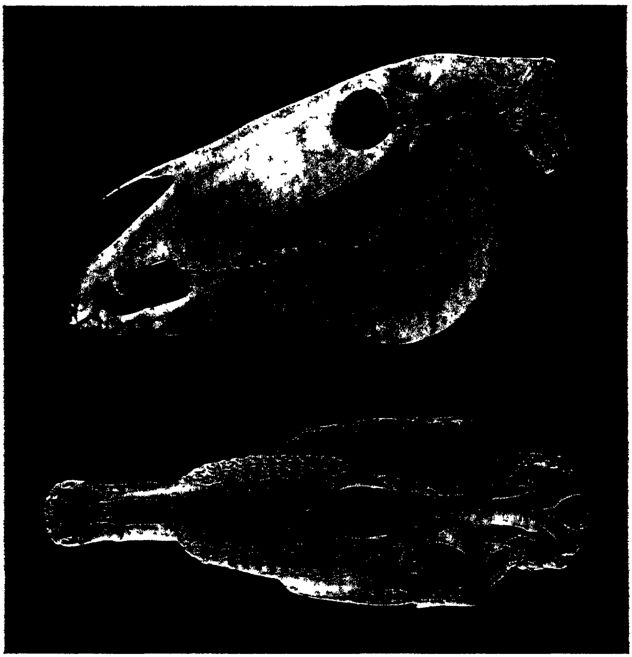

Fig 4. Skull of *E. scotti*.

skull is very much shortened in the portion between the last molar and the occipital condyles and most of this shortening seems to be in the basioccipital region, the orbits being placed much farther back. The maxillary ridge commences about the middle of p^4, while in *E. caballus* this ridge does not usually extend farther forward than the anterior portion of m^1. The vertical thickness of the skull measured immediately behind the last molar is about the same as in the large skull of *E. caballus*, but the thickness of the forward portion of the skull from the face of

the anterior premolar to the top of the nasals is much greater in *E. scotti.* The processes of the frontals inclosing the posterior portion of the orbits, slope more backward and are much narrower than in *E. caballus.* The occiput seems to be more overhanging; this is due probably to the great shortening of the basioccipital bone. The basioccipital ridge is not so compressed and the fossæ inclosed between the paroccipital processes and the condyles are much deeper. In these last two characters *E. scotti* (Fig. 5, *A*) is like *E. occidentalis* Cope (not of Leidy).[1] The posterior region of the skull, the posterior nares and the palate are narrower than in *E. caballus.*

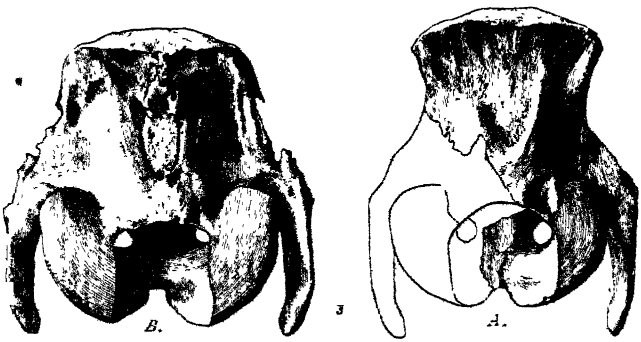

Fig. 5. *A*, occipital view of *E. scotti*; *B*, occipital view of *E. caballus.*

The lower jaw is more massive especially in the dental region. The jaw is much deeper, to accommodate the very long crowns of the molar-premolar series. This, together with the increased vertical thickness of the anterior portion of the skull, gives the whole head a more massive and less graceful form than that of *E. caballus.* Owing to the greater antero-posterior length of the molar-premolar series, the jaw seems to curve upward much more abruptly from the posterior molar. The symphysis mandibuli is heavier and longer than in *E. caballus*, extending back of the mental foramina. The jaw seems compressed laterally at the posterior part of the symphysis, owing to the wide expansion, anteriorly, to accommodate the wide incisors.

The other bones of the skeleton, taken separately, seem to be indistinguishable from those of *E. caballus.*

[1] Proc. Am. Phil. Soc., Vol. XXII, p. 11.

Article XIV.—LIST OF BIRDS COLLECTED IN THE DISTRICT OF SANTA MARTA, COLOMBIA, BY MR. HERBERT H. SMITH.

By J. A. Allen.

The basis of the present paper is a collection of 2834 birds collected under the direction of Mr. Herbert H. Smith, in the neighborhood of Santa Marta, Colombia, between sea-level and an altitude of about 8000 feet, from May 4, 1898, to September 7, 1899, and purchased for the American Museum of Natural History by its President, Morris K. Jesup, Esq., together with Mr. Smith's large collection of mammals obtained in the same region, as elsewhere noted.[1]

The Smith Collection of birds numbers 304 species, and includes all but 84 hitherto recorded from this small area. As a matter of interest and convenience to future workers in this field I have interpolated in brackets the species not obtained by Mr. Smith's collectors, and as a matter of geographical interest have deemed it best to give a complete summary of our present knowledge of the distribution of the species definitely known from the district under consideration, and have therefore cited the previous records as given by Messrs. Salvin and Godman and Mr. Outram Bangs.

As Messrs. Salvin and Godman stated in 1879 (Ibis, April, 1879, p. 197), in their report on the collection made in this region by Mr. F. Simons in 1878 and 1879: "There are few places in South America of which the zoology is less known than that of the mountainous tract of land lying between the mouth of the Magdalena river and the Gulf of Maracaibo, usually known as the Sierra Nevada of Santa Marta. Though this district has been visited by botanical travellers, no zoologist has as yet penetrated into it; or, at any rate, no results of any such expedition have been made public.[2] If we except the immediate neighborhood of Santa Marta itself, where several collectors have worked for a

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1 Bull. Am. Mus. Nat. Hist., Vol. XII, 1899, p. 195.

2 "In 1870 Mr. G. Joad, F.Z.S., rode round the Sierra Nevada from Santa Martha, and collected a few birdskins. Amongst these was the type of the new *Furnarius*, described by us in the 'Nomenclator' as *F. agnatus*, which was obtained at Valle Dupar."

short time, the remainder of this limited district is so little known that we can only recall the name of one bird, a Humming-bird (*Anthocephala floriceps*), found in it; and this was obtained by a botanist, so Mr. Gould tells us, near San Antonio, in the Nevada itself. Here, then, was a promising field for an ornithologist — this isolated mass of mountains, whose snowy peaks, visible from far out on the Caribbean Sea, form so striking a feature in the scenery on the northern coast of South America."

Mr. Simons worked mainly on the southern slope of the Sierra Nevada, at Valle Dupar, San Sebastian, Atanques, San José, and Chinchicua, these points varying in altitude from 700 to 11,000 feet. He ascended to 17,000 feet, and collected some specimens at altitudes above 14,000 feet. He also collected at Santa Marta and Minca, near the coast, and at Manaure, about ten miles southeast of Valle Dupar, on the eastern side of the valley of the Rio Cesar, at the foot of the western slope of the Cordillera de los Andes, and hence really outside of the Sierra Nevada region proper. A rectangular area of about 30 by 50 miles, the longer diameter being east and west, would include the whole district where Mr. Simons collected, and much more than cover the regions since visited by Mr. W. W. Brown in the interest of Mr. Bangs, and by Mr. Smith's collectors in the interest of this Museum.

This region, for the obvious reasons already quoted from Salvin and Godman, has of late presented strong attractions to a number of American naturalists, and for nearly a year before Mr. Smith's departure he had been preparing to thoroughly explore the Santa Marta district of Colombia, both zoölogically and botanically, beginning at sea-level and later working up to the highest points of the Sierra, it being his intention to devote from three to five years to the work, aided by a number of assistants. By a singular coincidence, Messrs. O. and E. O. Bangs, well-known naturalists of Boston, Mass., were at the same time arranging to send an experienced collector, Mr. W. W. Brown, Jr., to this same region, in absolute ignorance of Mr. Smith's plans, and Mr. Smith and myself were in equal ignorance of the plans of Messrs. Bangs. It happened that Mr. Brown was first on the ground, and his collections began to reach Boston long before any portion of Mr. Smith's were received here. For months after Mr. Smith's

arrival at Santa Marta he was laid up with a nearly fatal illness, and for the last year his work has been almost wholly suspended in consequence of the disturbed condition of the region, due to a violent insurrection in his immediate neighborhood. Although further shipments are expected from Mr. Smith, nothing has been received from him for many months, and it has therefore seemed desirable to place on record the results of his first shipments of birds, numbering, as already stated, nearly 3000 specimens, and to collate them with the published results of other collectors in this limited area, as recorded in the following papers:

1879–80. SALVIN, OSBERT, and F. DUCANE GODMAN. On a Collection of Birds from the Sierra Nevada of Santa Marta, Colombia. *Ibis*, 1879, pp. 196–206; 1880, pp. 114–125, 169–178, pll. iii–v.

1879. SIMONS, F. A. A. Notes on the Topography of the Sierra Nevada of Santa Marta, U. S. Colombia. *Proc. Roy. Geogr. Soc.*, I, Nov., 1879, pp. 689–701, with map.

1898. BANGS, OUTRAM. On Some Birds from Santa Marta, Colombia. *Proc. Biol. Soc. Wash.*, XII, pp. 131–144. Jan. 3, 1898.

1898. ——— ———. On Some Birds from Pueblo Viejo, Colombia. *Ibid.*, pp. 157–160. Aug. 10, 1898.

1898. ——— ———. On Some Birds from the Sierra Nevada de Santa Marta, Colombia. *Ibid.*, pp. 171–182. Oct. 31, 1898.

1899. ——— ———. On the Subspecies of *Manacus manacus* (Linn.). *Proc. N. England Zoöl. Club*, I, pp. 33–37. March 31, 1899.

1899. ——— ———. On Some New or Rare Birds from the Sierra Nevada de Santa Marta, Colombia. *Proc. Biol. Soc. Wash.*, XIII, pp. 91–108. Nov. 11, 1899.

1899. ——— ———. On a Small Collection of Birds from San Sebastian, Colombia. *Proc. N. Engl. Zoöl. Club*, pp. 75–80. Dec. 27, 1899.

1900. ——— ———. A New Dove from the Sierra Nevada de Santa Marta, Colombia. *Ibid.*, pp. 107–109. May 14, 1900.

Only two collections of birds of any considerable importance appear to have been made in the Santa Marta region of Colombia prior to the Smith collection. The first of these, made by Simons in 1878–79, was reported upon by Salvin and Godman in 1879–80, as above noted, the number of species recorded being 160. (The number of specimens in the collection is not stated.) Apparently two[1] other species were overlooked, or not reported in the Salvin-Godman paper, as shown by the record of the Salvin-

[1] *Doleromyia fallax* (Bourc.) and *Heliochera rubrocristata* (d'Orb. & Lafr.).

Godman collection given *passim* in the various volumes of the 'Catalogue of the Birds in the British Museum,' making a total of 162. Of this number 21 still rest on the authority of the Simons collection, being unrepresented in either the Brown or Smith collections. The following species were described as new:

1. Campylopterus phainopeplus.
2. Ramphomicron dorsale.
3. Oxypogon cyanolæmus.
4. Ochthœca poliogastra.
5. Basileuterus conspicillatus = B. cinereicollis *Sclater*.
6. Pœcilothraupis melanogenys.
7. Buarremon melanocephalus.

The second is the fine collection of about 2500 specimens made by Mr. Brown for the Bangs Brothers of Boston, in 1897–99, and reported upon by Mr. O. Bangs in the series of papers already cited, and which, it is to be hoped, will be followed by a general paper embodying the collector's field notes. Mr. Bangs appears to have recorded 242 species and subspecies, of which 40, and one genus, were described as new. While many of these new forms were now for the first time made known from the region, others are simply new names for species previously recorded by Salvin and Godman, the large amount of material now available for comparison showing them to be local forms entitled to subspecific recognition. In nearly all cases the abundant material in the Smith collection, in so far as such forms are represented in it, confirms Mr. Bangs's conclusions. As Mr. Brown collected extensively at altitudes above the points Mr. Smith has thus far reached, quite a number of Mr. Bangs's new forms are unrepresented in the Smith collection. The Brown collection contained 121 species not obtained by Simons, raising the number of species definitely known from the Santa Marta region to 283. Of this number 36 rest thus far solely on the authority of the Brown collection. Following is a list of the new forms, with their equivalents in the Salvin-Godman paper, so far as they are there represented:

1. Neocrex columbianus.
2. Geotrygon linearis infusca.
3. Aulacorhamphus lautus = A. albivittatus.
4. Galbula ruficauda pallida = G. ruficauda.
5. Pharomacrus festatus = P. fulgidens.
6. Melanerpes wagleri sanctæmartæ = Centurus tricolor.
7. Acestrura astreans = A. mulsanti.

8. Leucuria (gen. nov.) phalerata.
9. Metallura districta = M. smaragdinicollis?
10. Elænea sororia.
11. Elænea browni.
12. Myiopatis montensis.
13. Hapalocercus paulus.
14. Ochthodiæta pernix.
15. Pipreola auripectus decorus.
16. Manacus manacus abdivitus = Chiromachæris manacus.
17. Dendrocincla olivacea anguina.
18. Sclerurus albigularis propinquus.
19. Automolus rufipectus.
20. Grallaria spiator.
21. Conopophaga browni.
22. Scytalopus latebricola.
23. Arremonops caneus = Embernagra conirostris.
24. Sycalis browni.
25. Haplospiza nivaria = Phrygilus unicolor.
26. Spinus spinescens capitaneus.
27. Cyanocompsa concreta sanctæ-martæ.
28. Buarremon basilicus.
29. Piranga faceta.
30. Cyclorhis flavipectus canticus = C. flavipectus.
31. Diglossa nocticola.
32. Dacnis napæa.
33. Troglodytes monticola.
34. Thryothorus lætus.
35. Henicorhina anchoreta.
36. Cinclus rivularis.
37. Merula incompta.
38. Merula albiventris fusa.
39. Merula gigas cacozela = Turdus gigas.
40. Merula phæopyga minuscula.

The Smith collection, forming the basis of the present paper, contained nearly 3000 specimens, representing 304 species, and adding 105 to the list of positively known Santa Marta birds, which now numbers 388 species. Thus all but 84 of the 388 species are represented in the Smith collection, which also includes, as just said, 105 not previously recorded. In the course of the present paper the following species are described as new, namely:

Odontophorus atrifrons.
Myiobius assimilis.
Ochthœca jesupi.
Ochthœca olivacea.
Attila parvirostris.
Attila rufipectus.
Myiotherula sanctæ-martæ.
Hylophilus brunneus.

The Simons and Brown collections were both made in large part in the higher portions of the Sierra Nevada, while much of the Smith collection was gathered near the coast, only a small amount of collecting being done at altitudes above 5000 to 8000 feet. This sufficiently accounts for the absence from the Smith collection of a number of species obtained by Simons and Brown in the higher parts of the Sierra.

As will be seen from the list of species given below, very few water birds have been obtained from the Santa Marta district, neither Simons nor Brown collecting along the coast, and appar-

ently a week in September, 1898, covers the whole time spent by Mr. Smith's collectors on or near the seashore at Cienaga.

While to Mr. Smith is due the credit of organizing and equipping the Expedition and directing its work, he has personally done very little of the actual work of bird collecting, which has been carried on by Mrs. Smith, so well known for her previous work on similar expeditions in Southern Brazil, Mexico, and the lesser Antilles, and who, with Mr. G. H. Hull, appears to have secured and prepared the principal part of the collection of birds. Their further work in the Santa Marta region, if they are not driven out by the disturbed condition of the country, will probably add many more species to the list of Santa Marta birds.

In respect to the faunal relationships of the Santa Marta region, it may be said that while many wide-ranging species common to a large part of tropical America are found here, many of them are represented by geographical forms peculiar to this region, while in the higher parts of the Sierra Nevada occur many distinct species quite unlike their nearest congeners found elsewhere, and belonging for the most part to genera not found in the adjoining low coast region, but which occur in the Cordillera regions of other parts of northern South America. Also it may be noted that many of the species of the list which are abundant at the lower levels, are not recorded from points above 5000 to 6000 feet.

It is further evident that the avifauna of the Bogota region is very different from that of the Santa Marta district, and that also the home of many 'Colombia' species is to be looked for elsewhere than in eastern Colombia. Indeed, a very different set of birds was met with by Wyatt[1] in "the eastern Cordillera of the State of Santander," in the Bucaramanga district, midway between Santa Marta and Bogota.

Unfortunately no field notes are as yet available for publication, but the number of specimens taken of the different species, as here recorded, doubtless indicates to some extent the relative abundance of the species; while the dates, especially for North American migrants, indicate the season of occurrence.

I am indebted to Mr. Bangs for sending me for examination

[1] Notes on Some of the Birds of the United States of Colombia. By Claude W. Wyatt. Ibis, 1871, pp. 113–131, 319–335, 373–384. An annotated list of 210 species.

his large series of *Elænea browni* and *E. sororia*, and to Mr. Ridgway for the loan of material for comparison in several of the more difficult groups, and for his opinion on a few species sent to him for examination, as noted below. I am also indebted to Mr. Herbert H. Smith for the use of several hundred duplicates from the Santa Marta collection of birds, the whole collection sent by him to New York having been utilized in the preparation of the present paper. The number of specimens recorded under the different species thus includes the whole number sent.

The principal localities, with their approximate altitudes, visited by Simons and Brown, and by Smith's collectors, are for convenience of reference here listed in alphabetical sequence:

Agua Dulce, coast region, near Santa Marta.

Arehueca, near coast, 3 m. south of Cienaga.

Atanques, alt. 2800 ft. (Simons); 4000 ft. (Salv. & Godm.); about 10 m. north of Valle Dupar.

Bonda, alt. 150–250 ft., on Rio Manzanares, 10 m. east of Santa Marta.

Cacagualito, coast region, alt. 1500 ft.

Chinchicua, Valley of, in Sierra Nevada, alt. 6500 ft.

Chinchicua, Pass of, alt. 11,000 ft.

Chirua, in Sierra Nevada, alt. 4000 ft., Salv. & Godm.; 7000 ft., Bangs.

Chiruqua, Paramo de, or Pass of, 11,000–15,000 ft.

Concha, coast region, near Santa Marta.

Cienaga, coast, 20 m. south of Santa Marta.

El Libano, Sierra Nevada, alt. 6000 ft.

El Lorenzo, Sierra Nevada, alt. 7000–7500 ft.

El Mamon, Sierra Nevada, alt. 8000 ft.

Guallabol, alt. 3000 ft.

Jordan, coast, near Santa Marta.

La Concepcion, alt. 3000 ft.

Las Nubes, Sierra Nevada, alt. 5000 ft.

Macotama, alt. 8000 ft. (Bangs).

Macotama, Paramo de, or Pass of, 11,000–15,000 ft.

Mamatoco, near sea-level, 10 m. from Santa Marta.

Manaure, alt. 2700 ft., 20 m. S. E. of Valle Dupar, at base of western slope of Cordillera de los Andes.

Marocaso, alt. 2000 ft., on Rio Rancheria, southern slope of the Sierra Nevada.

Masinga Vieja, alt. 300 ft., on the Rio Manzanares, about 6 m. east of Bonda.

Minca (misspelled Minea by Simons and by Salvin & Godman), alt. 2000 ft., about 15 m. from the coast at head of Rio Gairu.

Naranjo, near coast, alt. 500 ft.
Onaca, near coast, alt. 2500 ft.
Palomina, in Sierra Nevada, alt. 5000 ft.
Paramo, see Chiruqua and Macotama.
Pueblo Viejo, Sierra Nevada, near San Sebastian, alt. 8000 ft.
Quebra Concha, see Concha.
Quebra Mojoba, near coast.
San Francisco, Sierra Nevada, alt. 6000 ft.
San José, Sierra Nevada, alt. 5000 ft.
San Lorenzo, Sierra Nevada, alt. 7500 ft.
San Miguel, Sierra Nevada, alt. 7500 ft.
San Sebastian, Sierra Nevada, alt. 6700 ft.
Santa Cruz, Sierra Nevada, alt. 8000 ft.
Santa Marta, coast, alt. 500 ft. Mr. Brown's collections from this point were made at altitudes of "from 500 to 1500 ft." (*Cf.* Bangs, Proc. Biol. Soc. Wash., XII, 1898, p. 131.)
Tayanga, coast, about 2 m. north of Santa Marta.
Valencia, alt. ——.
Valparaiso, Sierra Nevada, alt. 4500–5500 ft.
Valle Dupar, on a plain, south of the Sierra Nevada, near the mouth of the Rio Guatapuri.

1. Crypturus soui (*Hermann.*).[1]

Crypturus pileatus BANGS, Proc. Biol. Soc. Wash. XII, 1898, 132. Santa Marta.

Two specimens: Minca, Jan. 19; Bonda, April 6.

2. Crypturus columbianus *Salvadori.*

Crypturus columbianus BANGS, Proc. Biol. Soc. Wash. XII, 1898, 131. Santa Marta.

One specimen, Bonda, Nov. 14.

3. Tinamus ruficeps *Scl. & Salv.*

One specimen, Cacagualito, May 18.

4. Phalacrocorax vigua (*Vieill.*).

One specimen, Bonda, November.

5. Cancroma cochlearia *Linn.*

Two specimens, Minca, ♂ ad., June 29; Bonda, juv., March 21.

[1] = *Crypturus pileatus* (Bodd.) auct. *Cf.* Richmond, Auk, XVII, April, 1900, p. 179.

6. Nycticorax nycticorax nævius (*Bodd.*).

One specimen, ♂ ad., Bonda, June 10.

7. Tigrisoma salmoni *Scl. & Salv.*

Tigrisoma salmoni SALV. & GODM. Ibis, 1880, 178. Minca.

One specimen, Valparaiso, April 20.

8. Butorides striata (*Linn.*).

Butorides cyanurus SALV. & GODM. Ibis, 1879, 206 (no locality stated).

One specimen, Bonda, April 7.

9. Butorides virescens (*Linn.*).

One specimen, Bonda, October.

10. Agamia agami (*Gmel.*).

Ardea agami SALV. & GODM. Ibis, 1880, 178. Minca.

Two specimens: Mamatoca, ♂ ad., July 11; Bonda, juv., Dec. 9.

11. [Porzana albigularis *Lawr.*

Porzana albigularis BANGS, Proc. Biol. Soc. Wash. XII, 157, 172. Pueblo Viejo and Palomina.]

12. [Neocrex colombianus *Bangs.*

Neocrex colombianus BANGS, Proc. Biol. Soc. Wash. XII, 1898, 171. Palomina, one specimen.]

13. Aramides cajanus (*Müller*).

One specimen, Minca, July 6.

14. [Aramides axillaris *Lawr.*

Aramides axillaris BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 92. Chirua.]

15. Tryngites subruficollis (*Vieill.*).

Two specimens, Cienaga, Sept. 12 and 17.

16. Bartramia longicauda (*Bechst.*).

One specimen, Cienaga, Sept. 15.

17. Actitis macularia (*Linn.*).

Actitis macularia BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 92. La Concepcion, March 23.

Three specimens, Cienaga, Sept. 13 and 14.

18. Totanus solitarius (*Wils.*).

Rhyacophilus solitarius SALV. & GODM. Ibis, 1880, 178. Santa Marta.

Three specimens, Cienaga, Sept. 10–12.

19. Totanus flavipes (*Gmel.*).

One specimen, Cienaga, Sept. 12.

20. Micropalama himantopus (*Bonap.*).

One specimen, Cienaga, Sept. 13.

21. Tringa maculata (*Vieill.*).

One specimen, Cienaga, Sept. 14.

22. Tringa minutilla (*Vieill.*).

Eight specimens, Cienaga, Sept. 10–14.

23. Ereunetes pusillus (*Linn.*).

Two specimens, Cienaga, Sept. 12.

24. Ægialitis collaris (*Vieill.*).

Two specimens, Cienaga, Sept. 10 and 13.

25. Jacana nigra (*Gmel.*).

One specimen, Cienaga, Sept. 13.

26. Ortalis garrula (*Humb.*).

One specimen, Bonda, Nov. 5.

27. Chamæpetes goudoti (*Lesson*).

Fourteen specimens: El Libano, 13 specimens, April 21–29, and May 4–20; Valparaiso, 1 specimen, April 17.

28. Penelope argyrotis (*Bonap.*).

Penelope argyrotis BANGS, Proc. Biol. Soc. Wash. XII, 1898, 132. Santa Marta.

Three specimens, El Libano, April 24 and May 11 and 19.

29. Penelope cristata (*Linn.*).

One specimen, Bonda, Dec. 7.

30. Crax alberti *Fraser.*

Crax alberti BANGS, Proc. Biol. Soc. Wash. XII, 1898, 132. Santa Marta.

Three specimens, 1 adult and 2 chicks, Bonda, July 21 and 26, and Naranjo, July.

Young birds in first plumage show little resemblance to the adults, and may be thus described:

Frontlet and broad superciliaries dark rufous, with a similar line running from the angle of the mouth beneath the ear-coverts, which are deep buffy; top of the head blackish with a median and a broad lateral stripe on each side gray, the gray occupying only the tips of the feathers; nape blackish, more or less rufous on the median line; back mixed chestnut and blackish with many buffy-tipped feathers on the anterior portion, and posteriorly a broad white band on each side passes from the middle of the dorsal region to the base of the tail; tail black, tipped and varied with pale rufous; wings with the lesser coverts uniform rusty brown, the middle and greater coverts black broadly edged with rufous; quills black, the primaries broadly edged with rufous, the secondaries conspicuously barred with rufous; chin, throat, abdomen and thighs buffy white; breast dark ferruginous on the sides but lighter on the middle line; bill and feet flesh color. The only resemblance to the adult is the color pattern of the wings, in which the narrow white crossbars in the adult are replaced by broader rufous bars in the young.

31. Eupsychortyx leucopogon (*Lesson*).

Three specimens, Bonda, Jan. 5, Aug. 27, and Oct. 6.

32. Odontophorus atrifrons, sp. nov.

Type (and only specimen), No. 73246, ♂. ad., Valparaiso, March 25, 1899; coll. H. H. Smith.

Forehead, chin, throat, cheeks and ear-coverts uniform deep black; whole top of head and crest dark chestnut brown, passing into rufous on the sides of the ear-coverts; mantle olivaceous gray vermiculated with black; scapulars with the inner vanes black broadly barred and edged with chestnut, with light shaft-stripes, and central portion of outer vane gray; lower back olivaceous brown, the rump and upper tail-coverts similar but darker, with a few blotches of black at the tips of some of the feathers; tail dark brown, indistinctly barred with blackish and freckled with rusty; wings dark brown, the secondaries freckled and indistinctly barred with rusty, the primaries with broad distinct bars of pale rufous on the outer vanes; upper breast similar to the mantle, but varied slightly with buffy white, which takes the form of ill-defined apical spots on the lower border of this area; lower breast ochraceous rufous with indistinct crossbars and shaft-stripes of black; flanks buffy olivaceous brown, with black crossbars; lower tail-coverts black barred and tipped with rufous; bill deep black; feet dusky horn color. Wing, 130; tail, 87; tarsus, 44; culmen, 17 mm.

This species is readily distinguished by its wholly black forehead, throat and sides of the head, which are without any trace of whitish shaft-lines or other markings.

33. Geotrygon montana (*Linn.*).

One specimen, Bonda, June.

34. Geotrygon linearis infusca *Bangs.*

Geotrygon linearis BANGS, Proc. Biol. Soc. Wash. XII, 1898, 157. Pueblo Viejo.

Geotrygon linearis infusca BANGS, Proc. N. Engl. Zoöl. Club, I, 108, May 14, 1900. Chirua and La Concepcion.

Seven specimens, 5 adult and 2 juv. (nestlings): Valparaiso, 2 (juv.), May 24 and 25; El Libano, 4 specimens, April 22; San Lorenzo, 1 specimen, May 10.

35. Leptotila verreauxi *Bonap.*

Leptoptila verreauxi SALV. & GODM. Ibis, 1880, 178. Minca.

Leptotila verreauxi BANGS, Proc. Biol. Soc. Wash. XII, 1898, 132. Santa Marta.

Ten specimens, all from Bonda, taken June —, July 13, Aug. 3, 5 and 16, Oct. 4, Nov. 8 and 21, and Dec. 5.

36. Claravis pretiosa (*Ferrari-Perez*).[1]

Four specimens: Minca, Jan. 19: Cacagualito, May 13; Mamatoca (no date).

37. Columbigallina passerina granatina (*Bonap.*).

Columbigallina passerina pallescens BANGS, Proc. Biol. Soc. Wash. XII, 1898, 132. Santa Marta.

Eight specimens, all from Bonda, taken Jan. —, Feb. 23, July 11, Aug. 27, Sept. 13, Oct. 27, and Dec. 1.

38. Columbigallina rufipennis (*Bonap.*).

Chamæpelia rufipennis SALV. & GODM. Ibis, 1880, 178. Santa Marta.

Columbigallina rufipennis BANGS, Proc. Biol. Soc. Wash. XII, 1898, 132. Santa Marta.

Seventeen specimens: Bonda, 15 specimens, Jan. 10, June 25, July 5, Aug. 5 and 16, Oct. 7, Nov. 4–12; Masinga Vieja, 1 specimen, Sept. 7; Cienaga, Sept. 13.

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[1] = *Peristera cinerea* (Temm.) auct.; *cf.* Oberholser, Proc. Acad. Nat. Sci. Phila., 1899, p. 203.

39. [Scardafella squamosa (*Temm.*).

Sardafella [sic] *squamosa* SALV. & GODM. Ibis, 1880, 178. Valencia.]

40. Columba speciosa *Gmel.*

Five specimens, Bonda, Jan. 13, June 6, July 7, Dec. 8.

41. Columba albilineata *Gray.*

Columba albilineata BANGS, Proc. Biol. Soc. Wash. XII, 1898, 172 (Palomina); *ibid.* Proc. N. Engl. Zoöl. Club. I, 1899, 75 (San Sebastian and El Mamon).

One specimen, Valparaiso, April 16.

42. Columba gymnophthalma *Temm.*

One specimen, ♂ juv., Tayanga, June 22, is referred provisionally to this species. Probably more material would show that the mainland form is separable from true *C. gymnophthalma.*

43. Columba rufina (*Temm.*).

One specimen, Bonda, Aug. 1.

44. [Cathartes aura (*Linn.*).

Cathartes aura SALV. & GODM. Ibis, 1880, 178. Santa Marta.]

45. Gypagus papa (*Linn.*).

Gypagus papa BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 92. El Paramo de Macotama, Chirua, and La Concepcion.

One specimen, Bonda, Aug. 19.

46. Asturina nitida (*Lath.*).

Four specimens, Bonda, June —, July 22, Aug. 16 and 17 — 3 adults and 1 juv.

47. Rupornis magnirostris (*Gmel.*).

Asturina magnirostris SALV. & GODM. Ibis, 1880, 176. Santa Marta and Minca.

Rupornis magnirostris BANGS, Proc. Biol. Soc. Wash. XII, 1898, 132. Santa Marta.

Two specimens, Bonda, April 2 and Nov. 13.

48. Rupornis leucorrhoa (*Quoy & Gaim.*).

One specimen, ♂ ad., El Libano, May 23. Identified by Mr. Ridgway.

49. Buteo latissimus (*Wilson*).

Buteo pennsylvanicus SALV. & GODM. Ibis, 1880, 177. Minca, Jan. 17 and 22.

Buteo latissimus BANGS, Proc. Biol. Soc. Wash. XII, 1898, 132. Santa Marta, winter.

Seven specimens : Bonda, Feb. 9, March 26, Nov. 13–20, Dec. 22 ; Valparaiso, March 21.

50. Busarellus nigricollis (*Lath.*).

Two specimens, Bonda, March 8 and 29.

51. Urubitinga zonura (*Shaw*).

Three specimens, Bonda, March 11, May 26, and June 27.

52. Urubitinga anthracina (*Nitzsch*).

Urubitinga anthracina SALV. & GODM. Ibis, 1880, 177. Santa Marta.

Four specimens, Bonda, May 25, June 29, Aug. 23, and Sept. 1.

53. Geranoëtus melanoleucus (*Vieill.*).

One specimen, Agua Dulce, April 26.

54. Lophotriorchis isidorii (*Des Murs*).

One specimen, ♀ ad., Bonda, May 27.

55. Accipiter bicolor (*Vieill.*).

Four specimens : Bonda, May 17, Aug. 20, and Dec. — ; Onaca, Jan. 7.

56. Accipiter tinus (*Lath.*).

One specimen, Las Nubes, Dec. 19.

57. Micrastur semitorquatus (*Vieill.*).

Micrastur semitorquatus SALV. & GODM. Ibis, 1880, 177 (Valencia) ; BANGS, Proc. Biol. Soc. Wash. XII, 1898, 132 (Santa Marta).

Two specimens, Bonda, April 3 and Sept. 10.

58. Micrastur ruficollis (*Vieill.*).

Two specimens, Valparaiso, March 17 ; El Libano, April 29.

59. Geranospizias cærulescens (*Vieill.*).

One specimen, Bonda, April 2.

60. Falco rufigularis (*Daud.*).

Falco rufigularis BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 92. La Concepcion.

One specimen, Minca, June 20.

61. [Tinnunculus sparverius (*Linn.*).

Tinnunculus sparverius SALV. & GODM. Ibis, 1879, 206; 1880, 177 (Manaure and Valencia, May and June); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 172 (Palomina and San Miguel).]

62. Gampsonyx swainsoni *Vigors.*

Two specimens, Bonda, Feb. 14 and Dec. 1.

63. Rostrhamus sociabilis (*Vieill.*).

One specimen, Bonda, Aug. 22.

64. Leptodon cayanensis (*Gmel.*).

One specimen, Masinga, Aug. 21.

65. Leptodon uncinatus (*Temm.*).

Two specimens, Bonda, June 20.

66. Ictinea plumbea (*Vieill.*).

Ictinea plumbea SALV. & GODM. Ibis, 1879, 200. Manaure.

One specimen, Valparaiso, June 6.

67. Herpetotheres cachinnans (*Linn.*).

Two specimens, Bonda, June 14 and Nov. 28.

68. [Milvago chimachima (*Vieill.*).

Milvago chimachima SALV. & GODM. Ibis, 1880, 177. Valencia.]

69. Polyborus cheriway (*Jacq.*).

Polyborus cheriway SALV. & GODM. Ibis, 1880, 177. Valencia.

Five specimens, Bonda, Jan. 11, July 26, Aug. 23, Nov. 19.

70. Syrnium perspicillatum (*Latham*).

Syrnium perspicillatum BANGS, Proc. Biol. Soc. Wash. XII, 1898, 132. Santa Marta.

Three specimens, Bonda, Jan. 7, May —, and Aug. 29. The August specimen is still partly in nestling plumage, the whole

head, nape, throat (not the chin) and upper breast being in the white downy plumage of the young bird.

71. [Syrnium virgatum *Cassin.*

Syrnium virgatum BANGS, Proc. Biol. Soc. Wash. XII, 1898, 157. Santa Marta,—"one female just emerging from immature plumage, March 21, 1898."]

72. Glaucidium ferox (*Vieill.*).

Six specimens, Bonda, Jan. 11 and 18, Aug. 18, Oct. 13, and Nov. 30.

73. Pionus sordidus (*Linn.*).

Pionus sordidus BANGS, Proc. Biol. Soc. Wash. XII, 1898, 133, 172 (Santa Marta and San Miguel); *ibid.* Proc. N. Engl. Zoöl. Club, I, 1899, 75 (San Sebastian).

Two specimens, Valparaiso, April 6 and 7.

74. Pionus menstruus (*Linn.*).

Pionus menstruus BANGS, Proc. Biol. Soc. Wash. XII, 1898, 132. Santa Marta.

Three specimens, Bonda, June 27, and Aug. 3 and 15.

75. [Amazona amazonica (*Linn.*).

Chrysotis amazonica SALV. & GODM. Ibis, 1880, 176. Arihueca.]

76. [Amazona mercenaria (*Tsch.*).

Amazona mercenaria BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 92. "Two males, from Paramo de Chiruqua, 11,000 feet."]

77. Brotogerys jugularis (*Müller*).

Brotogerys tovi SALV. & GODM. Ibis, 1880, 176. Santa Marta.

Brotogerys jugularis BANGS, Proc. Biol. Soc. Wash. XII, 1898, 132. Santa Marta.

Thirty-three specimens, all from Bonda, collected Jan. 11, May 10, June 23–30, July 2 and 25–27, Aug. 8, 13 and 23, and Oct. 7.

78. [Psittacula guianensis (*Swains.*).

Psittacula cyanoptera SALV. & GODM. Ibis, 1880, 176. Valle Dupar and Valencia.

79. Conurus wagleri *Gray.*

Conurus wagleri SALV. & GODM. Ibis, 1879, 206 (Atanques); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 172 (Palomina and San Miguel).

One specimen, Valparaiso, March 23.

80. [Ara chloroptera *Gray.*

Ara chloroptera SALV. & GODM. Ibis, 1880, 176 (Valle Dupar); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 132 (Santa Marta).]

81. [Ara militaris (*Linn.*).

Ara militaris SALV. & GODM. Ibis, 1880, 176 (Arihueca); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 132 (Santa Marta).

One specimen, Bonda, Aug. 11.

82. Aulacorhamphus lautus *Bangs.*

Aulacorhamphus albivittatus SALV. & GODM. Ibis, 1879, 206. Chinchicua, altitude 6500 feet.

Aulacorhamphus lautus BANGS, Proc. Biol. Soc. Wash. XII, 1898, 173 (San Miguel); *ibid.* XIII, 1899, 92 (Chirua and La Concepcion).

Nineteen specimens, collected as follows: Valparaiso, 3 specimens, March 23 and April 12 and 13; San Lorenzo, 1 specimen, May 14; El Libano, 6 specimens, April 25, May 3, 6 and 20, and June 16; Las Nubes, 9 specimens, Dec. 8–14.

83. Aulacorhamphus calorhynchus *Gould.*

Aulacorhamphus calorhynchus SALV. & GODM. Ibis, 1879, 206 (Chinchicua); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 134, 158, 172 (Santa Marta, Pueblo Viejo and Palomina).

Fifteen specimens, all from Valparaiso, March and April.

84. Pteroglossus torquatus (*Gmel.*).

Pteroglossus torquatus SALV. & GODM. Ibis, 1880, 175 (Santa Marta and Minca); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 134 (Santa Marta).

Three specimens, Bonda, Sept. 2, Nov. 1, and Dec. 16.

85. [Rhamphastos brevicarinatus *Gould.*

Rhamphastos tocard SALV. & GODM. Ibis, 1879, 206. Manaure.

Rhamphastos brevicarinatus SCLATER, Cat. Bds. Brit. Mus. XIX, 1891, 126 (includes the Manaure specimen recorded by Salvin & Godman, *l. c.*); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 134, 157 (Santa Marta and Pueblo Viejo).

Two specimens: Bonda, November; Cacagualito, May 14.

[Rhamphastos carinatus *Swainson.*

Rhamphastos carinatus SALV. & GODM. Ibis, 1879, 206. "Manaure (2700 ft.), ♂, 18th May. . . . This is the first South American specimen I have seen, the range of the species being hitherto supposed to be restricted to Central America."

It is to be noted that no specimen of this species is recorded by Sclater (Cat. Bds. Brit. Mus. XIX, 1891, 126, 127) from south of Nicaragua, and only one specimen is recorded under *R. brevicarinatus* from Colombia. It therefore seems probable that the record of *R. carinatus* for Manaure, Santa Marta, U. S. Colombia, was made in error.]

86. Coccyzus americanus (*Linn.*).

Nine specimens, Bonda, Oct. 27 and 31, Nov. 8, 17 and 21.

87. Coccyzus melanocoryphus *Vieill.*

One specimen, Bonda, Aug. 7.

88. Coccyzus landsbergi *Bonap.*

One specimen, Cienaga, September.

89. Piaya cayana mehleri (*Bonap.*).

Piaya cayana SALV. & GODM. Ibis, 1879, 206. Valle Dupar.
Piaya cayana mehleri BANGS, Proc. Biol. Soc. Wash. XII, 1898, 133 (Santa Marta); *ibid.* Proc. N. Eng. Zoöl. Club, I, 1899, 76 (San Sebastian).

Nine specimens, all from Bonda, collected as follows: Jan. 13 and 24, Feb. 8, 22 and 24, Aug. 11, 18 and 22, and Sept. 5.

90. Crotophaga sulcirostris *Swainson.*

Crotophaga sulcirostris SALV. & GODM. Ibis, 1880, 175 (Santa Marta); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 133 (Santa Marta).

Eleven specimens: Santa Marta, 2 specimens, July 12 and 21; Bonda, Aug. 2, 3, 5 and 23, and Nov. 19. The last two are half-grown fledglings.

91. [Crotophaga ani *Linn.*

Crotophaga ani BANGS, Proc. Biol. Soc. Wash. XII, 1898, 172 (Palomina, one female).]

92. Malacoptila mysticalis *Sclater.*

Malacoptila mysticalis BANGS, Proc. Biol. Soc. Wash. XII, 1898, 133 (Santa Marta).

Seven specimens: Onaca, 2 specimens, Dec. 26 and 27; Valparaiso, 3 specimens, April 10 and June 1; Las Nubes, 2 specimens, Nov. 29 and Dec. 21.

93. Bucco ruficollis (*Wagler*).

Bucco ruficollis SALV. & GODM. Ibis, 1879, 205; 1880, 175 (Valle Dupar and Santa Marta); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 133 (Santa Marta).

Thirty-seven specimens, taken as follows: Santa Marta, 3 specimens, July 10 and 13; Bonda, 34 specimens, Jan. 17–31, Feb. 10–17, June 27 and 28, July 12–26, Aug. 21–30, Sept. 2–8, Oct. 7, Nov. 5, 8 and 21, Dec. 27.

94. Galbula ruficauda pallida *Bangs*.

Galbula ruficauda SALV. & GODM. Ibis, 1879, 205; 1880, 175. Santa Marta and Valle Dupar.

Galbula ruficauda pallida BANGS, Proc. Biol. Soc. Wash. XII, 1898, 133. Santa Marta.

Nine specimens: Cienaga, 1 specimen, September; Bonda, 8 specimens, June 28, Aug. 17 and 29, Oct. 6, Nov. 17 and 29.

95. Pharomacrus festatus *Bangs*.

Pharomacrus fulgidens SALV. & GODM. Ibis, 1879, 205. Valley of Chinchicua, 6500 feet.

Pharomacrus festatus BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 92. Chirua, altitude 7000 feet.

Three specimens, El Libano, altitude 6000 feet, April 29, May 6 and 18.

96. Trogon caligatus *Gould*.

Trogon caligatus SALV. & GODM. Ibis, 1880, 174. Minca.

Two specimens: Cacagualito, May 26, and Minca, July 27.

97. Trogon personatus *Gould*.

Trogon personatus BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 93. Chirua, La Concepcion, and Macotama.

Thirteen specimens: Valparaiso, 7 specimens, March 15–27, April 5, 6 and 19, May 25; Las Nubes, 1 specimen, Dec. 6; El Libano, April 23–26 and Dec. 14.

98. Momotus subrufescens *Sclater*.

Momotus subrufescens SALV. & GODM. Ibis, 1880, 174 (Santa Marta); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 133 (Santa Marta).

Twenty-six specimens, all from Bonda, Jan. 2, Feb. 2, 8 and 22, May 11, July 5, 7 and 27, Aug. 3–11 and 23, Oct. 8, Nov. 14–23.

99. Ceryle torquata (*Linn.*).

Ceryle torquata SALV. & GODM. Ibis, 1880, 174 (Santa Marta); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 133 (Santa Marta).

One specimen, Bonda, Sept. 8.

100. Ceryle amazona (*Lath.*).

Ceryle amazona BANGS, Proc. Biol. Soc. Wash. XII, 1898, 133. Santa Marta.

Three specimens, Bonda, Feb. 7, July 2, and Aug. 3.

101. Ceryle americana (*Gmel.*).

Ceryle americana SALV. & GODM. Ibis, 1880, 174 (Minca); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 133 (Santa Marta).

Fifteen specimens: Bonda, 12 specimens, Jan. 12, Feb. 4 and 22, June 28, July 10, Aug. 3 and 4, Sept. 1, Oct. 13, Nov. 15; Cienaga, 3 specimens, Sept. 13–15.

102. Melanerpes wagleri sanctæ martæ *Bangs.*

Centurus tricolor SALV. & GODM. Ibis, 1879, 205; 1880, 174. Santa Marta and Valle Dupar.

Melanerpes wagleri sanctæ-martæ BANGS, Proc. Biol. Soc. Wash. XII, 1898, 134. Santa Marta.

Twenty-five specimens: Santa Marta, 1 specimen, July 12; Bonda, 24 specimens, Jan. 17, Feb. 17, June 21–30, July 5, Aug. 3–21, Oct. 7–11, Nov. 17.

103. Chrysoptilus guttatus (*Spix*).

One specimen, Cienaga, Sept. 15.

104. Chloronerpes yucatanensis uropygialis (*Cab.*).

Chloronerpes yucatanensis uropygialis BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 93 (La Concepcion and San Miguel); *ibid.* Proc. N. Engl. Zoöl. Club, I, 1899, 76 (San Sebastian).

Five specimens, Valparaiso, March 18, April 8, 14 and 19, and June 11.

105. Ceophlœus lineatus (*Linn.*).

Ceophlœus lineatus BANGS, Proc. Biol. Soc. Wash. 1898, XII, 144. Santa Marta.

Two specimens: Minca, June 24, and Valparaiso, May 31.

106. Campephilus malherbii *Gray*.

Campephilus malherbii SALV. & GODM. Ibis, 1879, 205 (Atanques); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 134 (Santa Marta).

Seven specimens: Bonda, June, August and October; Valparaiso, March 17 and May 25; El Libano, May 3.

107. Picumnus cinnamomeus *Wagler*.

Two specimens, Bonda, Oct. 1.

108. Steatornis caripensis *Humb*.

One specimen, Bonda, Sept. —

109. Nyctidromus albicollis (*Gmel.*).

Nyctidromus albicollis SALV. & GODM. Ibis, 1880, 174 (Arihueca); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 135 (Santa Marta).

Eight specimens: Santa Marta, 1 specimen, July 14; Bonda, 7 specimens, Jan. 11, Aug. 28, Nov. 4 and 11.

110. [Antrostomus rufus (*Bodd.*).

Antrostomus rufus BANGS, Proc. N. Engl. Zoöl. Club, I, 1899, 78. San Sebastian, one specimen.]

111. Chætura spinicauda (*Temm.*).

One specimen, Cacagualito, May 11.

112. [Hemiprocne zonaris (*Shaw*).

Hemiprocne zonaris BANGS, Proc. Biol. Soc. Wash. XII, 1898, 158. Santa Marta, one specimen.]

113. Acestrura astreans *Bangs*.

Acestrura mulsanti SALV. & GODM. Ibis, 1879, 205. Atanques, 2700 feet. One specimen, ♀ ad.

Mr. Bangs (*l. c.*) thinks this may be the same as his *A. astreans*, which is quite probable.

Acestrura astreans BANGS, Proc. N. Engl. Zoöl. Club, I, 1899, 76. San Sebastian and El Mamon, 6600 to 8000 feet.

Three specimens, all females or immature males, Valparaiso, June 12 and 14, and Bonda, Sept. 27.

114. [Rhamphomicron dorsale *Salv. & Godm.*

Rhamphomicron dorsale SALV. & GODM. Ibis, 1880, 172, pl. v (Sierra Nevada, 2000 to 9000 feet); BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 94 (Paramo de Chiruqua, altitude 15,000 feet).]

115. [Oxypogon cyanolæmus *Salv. & Godm.*

Oxypogon cyanolæmus SALV. &. GODM. Ibis, 1880, 172, pl. iv, fig. 2. Sierra Nevada, 10,000 to 14,000 feet.]

116. Florisuga mellivora (*Linn.*).

Mellisuga mellivora SALV. & GODM. Ibis, 1880, 172 (Minca); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 135 (Santa Marta).

Three specimens: Bonda, Sept. 23 and Oct. 24; Cacagualito, May 14.

117. [Lafresnaya gayi (*Bourc. & Muls.*).

Lafresnaya gayi SALVIN, Cat. Bds. Brit. Mus. XVI, 1892, 329 (San José); BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 94 (Macotama, San Miguel, and Paramo de Chiruqua).]

118. [Campylopterus phainopeplus *Salv. & Godm.*

Campylopterus phainopeplus SALV. & GODM. Ibis, 1879, 202 (San José and Atanques, altitude 4000–5000 feet); *ibid.* 1880, 171, pl. iv, fig. 1 (San Sebastian, altitude 6700 feet)].

119. [Pygmornis striigularis (*Gould*).

Pygmornis striigularis BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 93. La Concepcion.]

120. [Phaëthornis anthophilus (*Bourc. & Muls.*).

Phaëthornis anthophilus SALV. & GODM. Ibis, 1880, 171 (Valle Dupar and Valencia); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 135 (Santa Marta).]

121. Phaëthornis longirostris (*Less. & Delattr.*).

Phaëthornis longirostris BANGS, Proc. Biol. Soc. Wash. XII, 1898, 134. Santa Marta.

Six specimens: Cacagualito, May 18 and 20; Las Nubes, Dec. 22 and 23.

122. Hylocharis cyanea (*Vieill.*).

Hylocharis cyanea BANGS, Proc. Biol. Soc. Wash. XII, 1898, 135. Santa Marta.

Six specimens: Bonda, Feb. 10, June 25, July 28, Oct. 8; Cacagualito, May 18; Jordan, May 11.

123. Floricola longirostris (*Vieill.*).

Floricola longirostris BANGS, Proc. Biol. Soc. Wash. XII, 1898, 135. Santa Marta.

Four specimens: Bonda, Feb. 21; Cacagualito, May 14, 21 and 27.

124. Leucuria phalerata *Bangs.*

Leucuria phalerata BANGS, Proc. Biol. Soc. Wash. XII, 1898, 174 (Macotama, one specimen; altitude 8000 feet); *ibid.* XIII, 1899, 93 (Paramo de Macotama, one specimen; altitude 15,000 feet).

Five specimens: El Libano, altitude 6000 feet, April 25, May 12–14.

Two specimens have the tail wholly pure white; the other three have the apical fourth of the tail blackish.

125. Helianthea, sp.

Two specimens, El Libano, April 27 and May 5, kindly identified by Mr. Ridgway as "females of some species of *Helianthea.*"

126. Amizillis[1] warszewiezi (*Cab. & Hein.*).

Saucerottia warszewiezi SALV. & GODM. Ibis, 1880, 173. Santa Marta and Minca.

Amazilia warszewiezi BANGS, Proc. Biol. Soc. Wash. XII, 135 (Santa Marta); *ibid.* Proc. N. Engl. Zoöl. Club, I, 1899, 78 (San Sebastian).

Twenty-two specimens, all from Bonda and immediate vicinity, taken as follows: Bonda, Jan. 5 and 20–25, June 25–27, July 2–7, Aug. 3–30, Sept. 5–7, Oct. 11 and 24, Nov. 11–16; Minca, July 25–27; Cacagualito, May 20.

127. Amizillis fuscicaudata (*Frazer*).

Amazilia fuscicaudata BANGS, Proc. Biol. Soc. Wash. XII, 1898, 135. Santa Marta.

Seven specimens: Bonda, Oct. 9 and Nov. 14; Cacagualito, May 7, 16, 20, 21 and 27.

128. Amizillis, sp.

One specimen, Bonda, Aug. 16.

[1] *Cf.* Oberholser, Proc. Acad. Nat. Sci. Phila., 1899, p. 207.

129. [Doleromyia fallax (*Bourc.*).

Doleromyia fallax SALVIN, Cat. Bds. Brit. Mus. XVI, 1892, 177.

Two specimens are recorded from "Northern Colombia (*F. Simons*)," but the species is not included in Salvin & Godman's 'Ibis' papers on Mr. Simons's collection.]

130. Anthocephala floriceps (*Gould*).

Anthocephala floriceps BANGS, Proc. Biol. Soc. Wash. XII, 1898, 158 (Pueblo Viejo) ; *ibid.* XIII, 1899, 94 (Pueblo Viejo, Santa Cruz, La Concepcion, San Francisco, and Chirua).

One specimen, Valparaiso, April 6.

131. Metallura districta *Bangs.*

Metallura smaragdinicollis? SALV. & GODM. Ibis, 1879, 205 (Valley of Chinchicua, one specimen, ♂ juv.) ; BANGS, Proc. Biol. Soc. Wash. XII, 1898, 194 (Palomina and San Miguel, two females).

Metallura districta BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 94. Pueblo Viejo, La Concepcion, San Miguel, Paramo de Macotama, and Paramo de Chiruqua.

Thirteen specimens : El Libano, 12 specimens, April 22–27, and May 1–12 ; Valparaiso, 1 specimen, March 7.

132. Chrysolampis moschitus (*Linn.*).

Twelve specimens, Bonda, June 24–28, July 1, 11 and 14.

133. Petasophora delphinæ (*Less.*).

Petasophora delphinæ SALV. & GODM. Ibis, 1880, 173 (Minca) ; BANGS, Proc. Biol. Soc. Wash. XII, 1898, 135 (Santa Marta).

Seven specimens, Bonda, Sept. 23–27.

134. Petasophora cyanotis (*Bourc. & Muls.*).

Petasophora cyanotis SALV. & GODM. Ibis, 1880, 173 (Minca and San Sebastian); BANGS, Proc. N. Engl. Zoöl. Club, I, 1899, 76 (San Sebastian and El Mamon).

Two specimens : Valparaiso, March 8 ; El Libano, April 25.

135. [Petasophora iolata *Gould*.

Petasophora anais SALV. & GODM. Ibis, 1880, 173 (San Sebastian and Sierra Nevada, 9200–10,000 ft.).

Petasophora iolata BANGS, Proc. Biol. Soc. Wash. XII, 1898, 173 (Macotama and San Miguel) ; *ibid.* Proc. N. Engl. Zoöl. Club, I, 1899, 76 (San Sebastian and El Mamon).]

136. Lampornis violicauda (*Bodd.*).

Lampornis violicauda BANGS, Proc. Biol. Soc. Wash. XII, 1898, 135. Santa Marta.

Eight specimens: Bonda, 5 specimens, Jan. 23 and 25, Feb. 23, Aug. 23, and Nov. 14; Cacagualito, May 16; Masinga, Nov. 15.

137. Hypuroptila buffoni (*Less.*).

Chalybura buffoni SALV. & GODM. Ibis, 1879, 205 (Manaure); *ibid.* 1880, 171 (Minca).

Hypuroptila buffoni BANGS, Proc. Biol. Soc. Wash. XII, 1898, 135 (Santa Marta).

Forty specimens: Bonda, 11 specimens, Jan. 10, Feb. 9, March 3, July 1, Aug. 12–22, Oct. 10, Nov. 8 and 23; Minca, 9 specimens, June 23, July 25–Aug. 3; Jordan, 1 specimen, May 11; Cacagualito, 18 specimens, May 10–27; Valparaiso, 2 specimens, June 8 and 10.

138. Thalurania columbica (*Bourc.*).

Thalurania columbica SALV. & GODM. Ibis, 1880, 172 (Minca and San José); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 135 and 174 (Santa Marta, San Miguel, and Palomina).

Forty-four specimens: Bonda, 2 specimens, Jan. 1 and Aug. 19; Onaca, 4 specimens, Jan. 6 and Dec. 28 and 29; Minca, 3 specimens, June 6, July 29, Aug. 4; Cacagualito, 1 specimen, May 27; Las Nubes, 7 specimens, Dec. 1–21; Valparaiso, 15 specimens, March 7, April 5, June 6–July 1; El Libano, 9 specimens, April 23–29, May 14.

139. Panychlora russata *Salv. & Godm.*

Panychlora, sp., SALV. & GODM. Ibis, 1879, 205; 1880, 174. Manaure and San Sebastian.

Panychlora russata SALV. & GODM. Ibis, 1881, 597 (San Sebastian and San José); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 174 (San Miguel and Palomina); *ibid.* Proc. N. Engl. Zoöl. Club, I, 1899, 76 (San Sebastian and El Mamon).

Two specimens, Bonda, Feb. 2 and July 2.

140. Chlorostilbon hæberlini (*Reich.*).

Chlorostilbon, sp., SALV. & GODM. Ibis, 1880, 174. Valencia, one female.

Four specimens, Bonda, July 8, Aug. 16, Oct. 11, and Nov. —.

141. [Glaucis hirsuta (*Gmel.*).

Glaucis hirsuta Bangs, Proc. Biol. Soc. Wash. XII, 1898, 134. Santa Marta].

142. Milvulus tyrannus (*Linn.*).

Milvulus tyrannus Salv. & Godm. Ibis, 1879, 202 (Manaure and San Sebastian); Bangs, Proc. Biol. Soc. Wash. XII, 1898, 137 and 176 (Santa Marta and Palomina); *ibid.* Proc. N. Engl. Zoöl. Club, I, 1900, 71 (San Sebastian).

Fifteen specimens: Bonda, Jan. 23–31, Feb. 4 and 22; Valparaiso, May 29; Cienaga, Sept. 8–14.

143. Tyrannus melancholicus satrapa (*Licht.*).

Tyrannus melancholicus Salv. & Godm. Ibis, 1879, 202. Atanques.

Tyrannus melancholicus satrapa Bangs, Proc. Biol. Soc. Wash. XII, 1898, 137 and 176 (Santa Marta, Palomina, and Macotaina); Proc. N. Engl. Zoöl. Club, I, 1900, 79 (San Sebastian).

Thirty-seven specimens: Bonda, 26 specimens, Jan. 6–Feb. 14, June 23–29, July 6–11, Sept. 1–8, Oct. 11, Nov. 14, Dec. 30; Minca, 4 specimens, June 28, July 5, 24, and Aug. 1; Onaca, 2 specimens, Dec. 31, Jan. 6; Cacagualito, 4 specimens, May 13–29; Valparaiso, 1 specimen, April 15.

144. Tyrannus griseus *Vieill.*

Tyrannus griseus Salv. & Godm. Ibis, 1880, 125. Santa Marta, April 3.

One specimen, Bonda, March 24.

145. [Tyrannus tyrannus (*Linn.*).

Tyrannus pipiri Salv. & Godm. Ibis, 1880, 125. Santa Marta, April 4.]

146. Myiarchus crinitus (*Linn.*).

Myiarchus crinitus Bangs, Proc. Biol. Soc. Wash. XII, 1898, 137. Santa Marta.

Five specimens, Bonda, Nov. 22, Dec. 5, Jan. 21, Feb. 10 and 27.

147. Myiarchus ferox (*Gmel.*).

Myiarchus tyrannulus Salv. & Godm. Ibis, 1880, 125 (Santa Marta); Bangs, Proc. Biol. Soc. Wash. XII, 1898, 137. Santa Marta.

Eight specimens, Bonda, Jan. 10 and 14, Feb. 18 and 22, June 27 and 29, Oct. 6, Nov. 25.

148. Myiarchus erythrocercus *Scl. & Salv.*

Myiarchus erythrocercus SALV. & GODM. Ibis, 1880, 125 (Santa Marta); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 137 (Santa Marta).

Fifty-five specimens, taken as follows: Bonda, 51 specimens, representing nearly every month of the year; Santa Marta, 3 specimens, July 12–14; Cacagualito, 1 specimen, May 19.

149. Myiarchus nigriceps *Sclater.*

Myiarchus nigriceps SALV. & GODM. Ibis, 1879, 125 (Minca); BANGS, Proc Biol. Soc. Wash. XII, 1898, 137, 158 and 176 (Santa Marta, Pueblo Viejo, Palomina, and Macotama).

Sixteen specimens: Minca, 9 specimens, May 30, June 19, July 26–31, Aug. 4; Onaca, 2 specimens, Dec. 28 and 29; Las Nubes, 1 specimen, Dec. 20; Cacagualito, 4 specimens, May 10, 20 and 28, and June 30; Valparaiso, 2 specimens, April 7 and 10.

150. Nuttallornis borealis (*Swains.*).

Contopus borealis SALV. & GODM. Ibis, 1880, 125. Minca.
Nuttallornis borealis BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 98. La Concepcion, March 8.

One specimen, San Lorenzo, May 13.

151. Contopus virens (*Linn.*).

Contopus virens SALV. & GODM. Ibis, 1880, 125. Santa Marta.

Two specimens: Valparaiso, April 19; Cacagualito, May 10.

152. Contopus brachytarsus (*Sclater*).

Contopus brachytarsus BANGS, Proc. Biol. Soc. Wash. XII, 1898, 137. Santa Marta.

Six specimens: Minca, July 31 and Aug. 3; Cacagualito, May 12, 14 and 17.

153. Empidonax virescens (*Vieill.*).

Empidonax virescens BANGS, Proc. Biol. Soc. Wash. XII, 1898, 137. Santa Marta, winter.

Four specimens: Bonda, Nov. 16; Onaca, Dec. 28 and Jan. 5; Valparaiso, March 21.

154. Empidonax ridgwayi *Sclater.*

Six specimens, Bonda, Aug. 27, Sept. 6–8, Oct. 7–24.

155. Empidochanes cabanisi (*Léotaud*).[1]

Five specimens: Concha, Aug. 18; Bonda, Sept. 6, Jan. 20, Feb. 27; Valparaiso, May 16.

156. [Pyrocephalus rubinus (*Bodd.*).

Pyrocephalus rubineus SALV. & GODM. Ibis, 1879, 202 (Valle Dupar); *ibid.* 1880, 125 (Valencia).]

157. Myiobius erythrurus *Cabanis.*

One specimen, Jordan, May 11.

158. Myiobius assimilis, sp. nov.

Myiobius vieillotioides SALV. & GODM. Ibis, 1880, 125 (San Sebastian). Not *M. vieillotioides* Lafr.

Myiobius vieillotioides BANGS, Proc. Biol. Soc. Wash. XII, 1898, 176 (San Francisco). Not *M. vieillotioides* Lafr.

Type, No. 72629, ♂ ad., Valparaiso (altitude 5500 feet), March 7, 1899; coll. H. H. Smith.

Above deep rufous slightly darker on pileum and nape; concealed crest deep golden; rump band deep cinnamon rufous, much lighter than the back, but much deeper than in *M. vieillotioides;* below deep rufous, strongest over the breast and fore neck, lighter on the abdomen and lower tail-coverts; chin dusky ashy suffused with rufous; tail deep rufous like the back, shaded with dusky for about the apical sixth, the dusky portion forming an ill-defined subterminal band, the feathers being tipped with deep rufous; the wing-coverts rufous with blackish bases, the dusky portion almost wholly concealed by the broad rufous tips; quills, including outer primaries, rufous externally, the primaries passing into dusky apically. Length, 133 mm.; wing, 69; tail, 60; tarsus, 13; culmen, 15.

The female does not differ appreciably from the male; young birds differ from the adult chiefly in wholly lacking the bright yellow crown patch.

Myiobius assimilis is most nearly related to *M. vieillotioides* Lafr, the type locality of which is Caracas, Venezuela, but differs from it in being deeper rufous throughout, with very little of the dusky shading on the pileum and nape so characteristic of *M. vieillotioides*, and in having the tail almost wholly rufous instead of mainly dusky, and with much less black on the remiges.

This species is represented by 30 specimens, collected as follows: Valparaiso, 13 specimens, March 7–19 and April 4–15;

[1] *Cf.* Chapman, this Bulletin, VI, 1894, 42.

El Libano, 4 specimens, April 27 and 28, and May 6 and 12; Las Nubes, 13 specimens, Nov. 10 and 28, and Dec. 10–22. All were collected at points between 5000 and 6000 feet elevation. This series is remarkably uniform in size and coloration.

Four specimens from Las Palmales, Venezuela (F. W. Urich), representing true *M. vieillotioides*, differ very markedly from the Santa Marta series.

159. Myiobius nævius (*Bodd.*).

Myiobius nævius BANGS, Proc. Biol. Soc. Wash. XII, 1898, 158 and 178. Pueblo Viejo and Palomina.

One specimen, Minca, July 24.

160. Muscivora mexicana *Sclater.*

Muscivora mexicana SALV. & GODM. Ibis, 1879, 202 (Manaure); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 137 (Santa Marta).

Ten specimens: Bonda, 6 specimens, Oct. 11, Nov. 3, 8, 18 and 24, Minca, June 3, and July 31; Cacagualito, May 22.

161. Megarhynchus pitangua (*Linn.*).

Megarhynchus pitangua SALV. & GODM. Ibis, 1879, 201 (Atanques); 1880, 125 (Santa Marta); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 137 and 176 (Santa Marta and Palomina).

Seventeen specimens: Bonda, Jan. 23–26, Feb. 22, June 23–29, July 3, 9 and 13, Aug. 16 and 27, Sept. 4, Nov. 12; Minca, June 23.

162. Myiodynastes audax nobilis (*Sclater*).

Myiodynastes audax SALV. & GODM. Ibis, 1879, 201. Manaure.

Myiodynastes nobilis SCLATER, Cat. Bds. Brit. Mus. XIV, 1888, 184. Minca, Valle Dupar, Manaure, and Santa Marta (the latter the type locality).

Myiodynastes audax nobilis BANGS, Proc. Biol. Soc. Wash. XII, 1898, 137 and 176 (Santa Marta and Palomina).

Twenty-seven specimens, taken as follows: Bonda, 18 specimens, Jan. 16 and 26, Feb. 22, May 10, June 18–July 2, Aug. 5 and 18, Sept. 4, Nov. 17, Dec. 5–12; Minca, 4 specimens, June 22, July 21 and 31; Cacagualito, 5 specimens, May 12–26, June 3.

163. Myiodynastes chrysocephalus (*Tsch.*).

Myiodynastes chrysocephalus BANGS, Proc. Biol. Soc. Wash. XII, 1898, 158 and 176. Pueblo Viejo and San Francisco.

Ten specimens: El Libano, May 6; Valparaiso, March 11, 17 and 29, April 13, and May 31; Las Nubes, Dec. 8–20.

164. Pitangus derbianus rufipennis (*Lafr.*).

Pitangus derbianus SALV. & GODM. Ibis, 1879, 201. Valle Dupar.
Pitangus derbianus rufipennis BANGS, Proc. Biol. Soc. Wash. XII, 1898, 137. Santa Marta.

Four specimens: Bonda, June 29, July 15, Sept. 7; Santa Marta, July 14.

165. Pitangus lictor (*Licht.*).

One specimen, Cacagualito, May 14.

166. Rhynchocyclus sulphurescens (*Spix*).

Rhynchocyclus sulphurescens BANGS, Proc. Biol. Soc. Wash. XII, 1898, 136 and 176. Santa Marta and Palomina.

Three specimens: Minca, Aug. 3; Bonda, Nov. 18 and Jan. —.

167. Rhynchocyclus flaviventris (*Wied*).

Rhynchocyclus flaviventris SALV. & GODM. Ibis, 1880, 124 (Santa Marta); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 136 (Santa Marta).

Thirty-six specimens, all collected at Bonda, except one, as follows: Jan. 11–27, Feb. 2–17, July 1–11 and 14, Aug. 10–17, Sept. 7, Oct. 12 and 13, Nov. 5–28; Dec.—; Cacagualito, May 24.

168. Rhynchocyclus æquinoctialis (*Sclater*).

Two specimens, Onaca, Dec. 28 and 29.

169. Myiozetetes texensis colombianus (*Cab. & Hein.*).

Myiozetetes texensis colombianus BANGS, Proc. Biol. Soc. Wash. XII, 1898, 136 and 176. Santa Marta and Palomina.

Nine specimens: Bonda, Jan. 9 and 19, and Oct. 28; Minca June 22; Santa Marta, July 15; Cacagualito, May 5 and 11.

170. Sublegatus glaber *Scl. & Salv.*

Sublegatus glaber WYATT, Ibis, 1871, 333 (Santa Marta); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 136 (Santa Marta).

Two specimens, Bonda, Jan. 31, June 21.

171. [Sublegatus platyrhyncha *Scl. & Salv.*

Sublegatus incanescens SALV. & GODM. Ibis, 1880, 124 (Minca).]

172. Legatus albicollis (*Vieill.*).

Legatus albicollis SALV. & GODM. Ibis, 1880, 124. Minca.

Eleven specimens: Bonda, June 22 and 27, and Aug. 5 and 22; Minca, June 22, July 22 and 31; Jordan, May 11.

173. Elænea pagana (*Licht.*).

Elænea pagana SALV. & GODM. Ibis, 1880, 124 (Minca); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 136 (Santa Marta); Proc. N. Engl. Zoöl. Club, I, 1900, 79 (El Mamon).

Twenty specimens: Bonda, 13 specimens, Jan. 14 and 31, Feb. 7–11 and 27, May 11, July 5, and Aug. 22; Minca, July 26 and 27; Onaca, Jan. 7; Santa Marta, July 10–13; Cacagualito, May 24 and June 3.

174. Elænea pagana sororia *Bangs.*

Elænea sororia BANGS, Proc. Biol. Soc. Wash. XII, 1898, 175. Palomina and San Miguel.

Eleven specimens: Bonda, Jan. 31, Feb. 11 and 27, and July 11; Minca, Jan. 7 and July 27; Santa Marta, July 10–13.

Elænea sororia Bangs is very closely related to *E. albiceps*, with which it appears to intergrade, as does *E. albiceps* with *E. pagana.*[1]

175. Elænea browni *Bangs.*

Elænea browni BANGS, Proc. Biol. Soc. Wash. XII, 1898, 158 and 175 (Pueblo Viejo and San Miguel); *ibid.* Proc. N. Engl. Zoöl. Club, I, 1900, 78 (San Sebastian and El Mamon).

Twelve specimens: El Lorenzo (alt. 7000 ft.), May 12 and 13; El Libano (alt. 6000 ft.), April 25 and May 21; Valparaiso (alt. 5500 ft.), April 1–5.

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[1] See this Bulletin, II, 1889, pp. 183–208.

Also a specimen collected at Minca, July 25, and another at Bonda, Feb. 3, seem referable here. All the specimens I have seen, including most of Mr. Bangs's series, that have been taken above 5000 feet altitude, prove referable to this very well marked form.

176. Myiopagis placens (*d'Orb. & Lafr.*).

Myiopagis placens BANGS, Proc. Biol. Soc. Wash. XII, 1898, 136. Santa Marta.

Four specimens: Bonda, Feb. 10, Sept. 18 and Nov. 5; Minca, Aug. 2.

177. Myiopagis gaimardi (*d'Orb.*).

Myiopagis macilvainii BANGS, Proc. Biol. Soc. Wash. XII, 1898, 136. Santa Marta.

Fifteen specimens, Bonda, Jan. 21–23, June 30, Aug. 1–26, Sept. 5, Oct. 13, Nov. 17, Dec. 12.

178. Tyranniscus nigricapillus (*Lafr.*).

Tyranniscus nigricapillus BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 98. La Concepcion and Chirua.

Four specimens: El Libano, April 5, 25, and May 14; San Lorenzo, May 12.

179. Tyranniscus griseiceps *Scl. & Salv.*

Tyranniscus griseiceps BANGS, Proc. Biol. Soc. Wash. XII, 1898, 136. Santa Marta.

Two specimens, Minca, June 18 and Aug. 3.

180. Tyranniscus chrysops (*Sclater*).

Tyranniscus chrysops SALV. & GODM. Ibis, 1880, 124 (Minca); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 175 (Palomina).

Four specimens, Minca, July 24 and 29 and Aug. 2 and 4.

181. Tyrannulus elatus (*Lath.*).

Two specimens, Bonda, Feb. 4 and Aug. 16.

182. Ornithion pusillum (*Cab. & Hein.*).

Ornithion pusillum BANGS, Proc. Biol. Soc. Wash. XII, 1898, 136. Santa Marta.

Four specimens, Bonda, Feb. 2, Aug. 30 and 31, Sept. 10.

183. Ornithion inerme *Hartl.*

Four specimens, Bonda, Jan. 20, Aug. 8 and 14, and Sept. 1.

184. Myiopatis semifusca *Sclater.*

Phyllomyias semifusca SALV. & GODM. Ibis, 1879, 201. Atanques.
Myiopatis semifusca BANGS, Proc. Biol. Soc. Wash. XII, 1898, 136. Santa Marta.

Fifty-six specimens, all from Bonda except one, collected as follows: Jan. 10, 18 and 27, Feb. 2, 4, 11 and 27, May 19, July 7, 9, 11 and 13, Aug. 11, 15, 16, 25–29, Sept. 5–8, Oct. 4, 12, 13, 27, Nov. 11, 19; Cacagualito, May 24.

185. [Myiopatis montensis *Bangs.*

Myiopatis montensis BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 97. Macotama, altitude 9000 feet, to Paramo de Chiruqua, altitude 12,000 feet.]

186. Leptopogon amaurocephalus *Cabanis.*

Two specimens, Bonda, Dec. 12 and Jan. 13.

These specimens agree very closely with examples from southern Brazil (Rio de Janeiro and Matto Grosso), and are referable here rather than to *L. amaurocephalus pileatus* (Sclater).

187. Mionectes olivaceus *Lawr.*

Mionectes olivaceus BANGS, Proc. Biol. Soc. Wash. XII, 1898, 158. Pueblo Viejo.

Twenty-six specimens: Minca, 1 specimen, July 24; Onaca, 1 specimen, Dec. 31; Valparaiso, 20 specimens, March 10–May 26; El Libano, 4 specimens, April 22 and May 5–9.

188. Mionectes oleagineus (*Licht.*).

Mionectes oleagineus BANGS, Proc. Biol. Soc. Wash. XII, 1898, 136. Santa Marta.

Twenty-four specimens: Bonda, 20 specimens, Jan. 10–28, Feb. 11 and 14, Aug. 23–30, Sept. 3, Oct. 4–13, Nov. 9–25; Minca, 2 specimens, Jan. 19 and July 27; Cacagualito, May 12–20.

189. [Serpophaga cinerea grisea (*Lawr.*).

Serpophaga cinerea grisea BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 97. Chirua, San Miguel, and La Concepcion.]

190. [Hapalocercus paulus *Bangs.*

Hapalocercus paulus BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 96. Chirua, San Miguel, and La Concepcion.]

191. Colopterus pilaris *Cabanis.*

Colopterus pilaris SALV. & GODM. Ibis, 1880, 124 (Minca); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 136 (Santa Marta).

Twenty-one specimens, collected as follows: Bonda, 17 specimens, Jan. 11–21, Feb. 3–18, Aug. 8, 13 and 22, Nov. 3 and 10; Minca, 1 specimen, July 29; Cacagualito, 3 specimens, May 10–28.

192. Euscarthmus granadensis (*Hartl.*).

Euscarthmus granadensis BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 98. La Concepcion.

One specimen, El Libano, May 6.

193. Euscarthmus impiger *Scl. & Salv.*

Euscarthmus impiger BANGS, Proc. Biol. Soc. Wash. XII, 1898, 136. Santa Marta.

Twenty-one specimens: Bonda, Jan. 12–27, Feb. 3, 8, 21 and 25, Aug. 19–22, Sept. 4, Oct. 9 and 21, and Dec. 19; Cacagualito, May 16.

194. Todirostrum cinereum (*Linn.*).

Two specimens, Cienaga, Sept. 9.

195. Todirostrum nigriceps *Sclater.*

Todirostrum nigriceps BANGS, Proc. Biol. Soc. Wash. XII, 1898, 135. Santa Marta.

Four specimens, Bonda, July 14, Aug. 16 and 31, and Nov. 21.

196. Todirostrum schistaceiceps *Sclater.*

Todirostrum schistaceiceps BANGS, Proc. Biol. Soc. Wash. XII, 1898, 135. Santa Marta.

Five specimens, Bonda, Jan. 11–13, Feb. 3, and Aug. 1.

197. [Platyrhynchus albogularis *Sclater.*

Platyrhynchus albogularis BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 96. La Concepcion, "one female."]

198. Machetornis rixosa (*Vieill.*).

One specimen, Cacagualito, May 28.

199. Fluvicola pica (*Bodd.*).

Two specimens, Cienaga, Sept. 8 and 9.

200. Sayornis cineracea (*Lafr.*).

Sayornis cineracea SALV. & GODM. Ibis, 1879, 201 (San José); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 135 and 174 (Santa Marta and San Miguel); *ibid.* Proc. N. Engl. Zoöl. Club, I, 1900, 78 (San Sebastian).

Two specimens, Cacagualito, June 1, and Onaca, Dec. 27.

201. [Ochthœca poliogastra *Salv. & Godm.*

Ochthœca poliogastra SALV. & GODM. Ibis, 1880, 123 (Sierra Nevada de Santa Marta, type locality); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 174 (Macotama); *ibid.* XIII, 1899, 96 (Sierra Nevada, "at all stations between 9000 and 12,000 feet.

Probably not found much below 9000 feet, as it was not taken by Mr. Smith's collectors.]

202. Ochthœca jesupi,[1] sp. nov.

Type, No. 72727, ♀ ad., San Lorenzo, altitude 7000 feet, May 12, 1899; coll. H. H. Smith.

Above olive, with a slight tinge of dusky on the head; clear olive on nape and anterior part of back, passing into brownish olive on the lower back, rump and upper tail-coverts; wings and tail dusky, the feathers narrowly edged with olive on the tail and with brownish olive on the wings; greater coverts narrowly tipped with brownish, forming a barely recognizable wing-bar; superciliaries and a narrower frontal band yellow, the superciliaries broad in front of the eyes, much narrower behind the eyes; lores blackish; ear-coverts dusky tinged with olive; below throat and breast greenish yellow, passing into clear strong yellow over the abdomen and crissum; flanks olive tinged more or less with yellow. Bill black, feet horn color. Wing, 55 mm.; tail, 49; tarsus, 17; culmen, 9.

While *Ochthœca jesupi* is very distinct from any other described species of the genus it finds its nearest ally in *O. gratiosa* Sclater from Ecuador, from which it differs in being olive instead of brown above, with rather yellower under parts, narrower frontal

[1] Named in honor of Morris K. Jesup, Esq., President of the American Museum of Natural History, to whom the Museum is endebted for the fine collection of Colombian birds of which this species forms a part.

band and superciliaries, and in the absence of well-defined wing-bars. It is also somewhat smaller, as compared with Bogota specimens identified as *O. gratiosa* by Dr. Sclater.

This species is represented by four specimens, taken as follows: San Lorenzo, altitude 7000–7500 feet, May 12 and 13; El Libano, altitude 6000 feet, May 3; Valparaiso, altitude 5500 feet, March 8.

203. Ochthœca olivacea, sp. nov.

Type, No. 72728, ♂ ad., Valparaiso, altitude 5500 feet, April 14, 1899; coll. H. H. Smith.

Above dark clear greenish olive, blackish on the head, fading on the hind head into the uniform deep greenish olive of the rest of the upper surface; wings and tail dusky, the latter strongly edged with olive; wing-coverts and outer edge of secondaries, except basally, broadly edged with greenish yellow; primaries 2–5 similarly edged for the proximal half of their length, the others wholly black externally, like the proximal third of the secondaries, forming a conspicuous wing pattern of black and light greenish yellow; bend of wing and under coverts bright greenish yellow; frontal band and superciliaries clear white; sides of head grayish white, except a small black loral spot; ear-coverts dusky; below throat and fore neck white or greenish white; breast and sides gray with an olive tinge, slightly flammulated with yellow; abdomen and crissum greenish yellow. Bill and feet deep black. Wing, 54 mm.; tail, 46; tarsus, 18; culmen, 14.

Ochthœca olivacea bears a general resemblance to *O. diademata*, its nearest ally, but differs from it in having the frontal band and superciliaries clear white instead of yellow, and in the rump being deep olive green like the back instead of rufescent. It is represented by five specimens, all taken at Valparaiso, April 5 and 14, 1899.

204. Ochthodiæta pernix *Bangs.*

Ochthodiæta pernix BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 95. Macotama, one specimen.

One specimen, San Lorenzo, May 12.

205. [Myiotheretes striaticollis *Sclater.*

Myiotheretes striaticollis BANGS, Proc. Biol. Soc. Wash. XII, 1898, 174 (Macotama); Proc. N. Engl. Zoöl. Club, I, 1900, 78 (El Mamon.)]

206. [Heliochera rubrocristata (*d'Orb. & Lafr.*).

Heliochera rubrocristata SCLATER, Cat. Bds. Brit. Mus. XIV, 1888, 390 (Sierra Nevada de Santa Marta, coll. by Simons); BANGS, Proc. Biol. Soc.

Wash. XIII, 1899, 98 (Paramo de Chiruqua and Paramo de Macotama, 11,000 to 15,000 feet).]

207. Attila parvirostris, sp. nov.

Type, No. 72656, Minca, June 5, 1899; coll. H. H. Smith.

Above ferrugineous brown, front and lores whitish; narrow blackish shaft-lines on forehead only; rump ochraceous yellow; tail bright ferrugineous; wings blackish, the primaries slightly edged with pale rufous, the secondaries and median and greater coverts broadly edged with deep rufous, forming two conspicuous wing-bars on the coverts; inner wing-coverts and axillars pale ochraceous, as are the inner edges of the secondaries, fading to pale buffy white on the basal portion of the primaries; chin and throat whitish; breast and sides of abdomen olivaceous, the feathers broadly centered with dusky and edged with greenish yellow; middle of abdomen white faintly tinged with yellow; flanks ochraceous; crissum and under tail-coverts pale yellow; bill, in the type, deep black; feet horn color. Wing, 85 mm.; tail, 70; tarsus, 22; culmen, 21.

In general coloration this species is a miniature of *A. citreopygius*, but besides being very much smaller it lacks the strong black striations on the head and throat of that species, and has a more olivaceous breast. The difference in size is striking, the bill of *A. citreopygius* being twice as large as that of *A. parvirostris*, while the length of the wing in *A. citreopygius* is 93 mm. as against 85 mm. in *A. parvirostris*. It is also much smaller than *A. sclateri*, and differs from it strikingly in color.

In addition to the type from Minca, I refer doubtfully to this species two specimens from Valparaiso, taken March 10 and 17, which differ in having the bill horn color, and in having very little olivaceous below, the breast in one specimen being gray slightly tinged with olivaceous, and in the other gray with a brownish tinge; the tail in both is dusky rufous brown instead of ferrugineous. The difference may be seasonal, but I suspect it is specific; it seems, however, better to await further material before deciding.

208. Attila rufipectus, sp. nov.

Type, and only specimen, No. 71183, Las Nubes, altitude 5000 feet, Dec. 1, 1898; coll. H. H. Smith.

Above dark ferrugineous brown; front and superciliaries pale cinnamon rufous, with narrow blackish shaft-streaks formed by the black bristly feather tips; rump ochraceous; wings blackish, the median and greater coverts and the secondaries edged with dull brownish ferrugineous; inner coverts, axillars, and inner border of secondaries buffy ochraceous, fading to pale rufous on the basal

portion of the primaries; tail dusky rufous brown, like the back; chin and upper throat pale buffy white, with narrow black shaft-streaks formed by the bristly feather tips; breast dull rufous flammulated with darker; rest of lower parts including crissum, very pale rufous, rather stronger on the flanks; bill and feet horn color. Wing, 83 mm.; tail, 75; tarsus, 23.5; culmen, 22.

Attila rufipectus is a near ally of *A. spadiceus* of Guiana and Brazil, resembling it both in size and general coloration, from which it may prove to be only subspecifically separable. It is apparently nearer this than to *Attila flammulatus* Lafresnaye, said to have come from "Colombia," and the only species of *Attila* heretofore attributed to Colombia. Although the type and only known specimen of *A. rufipectus* differs widely from Lafresnaye's description of *A. flammulatus*, further material may show that Lafresnaye's name will have precedence.

In this connection I may add that *Attila cinnamomeus* Lawrence, rom Mazatlan, Mexico, of which an authentic example is before me, belongs to the same group as the present species but differs in its wholly white under parts, flammulated on the breast and fore neck with dark ashy.

209. Pachyrhamphus cinereiventris *Sclater.*

Pachyrhamphus niger SALV. & GODM. Ibis, 1880, 169 (not of Spix). Santa Marta.

Pachyrhamphus cinereiventris SCLATER, Cat. Bds. Brit. Mus. XIV, 1888, 344 (includes the Simons specimens collected at Santa Marta, recorded by Salvin & Godman, *l. c.*).

Eighteen specimens: Bonda, 16 specimens, June 21, July 5, Aug. 1–24, Sept. 6, Oct. 13, 24 and 27, and Nov. 3; Cienaga, 1 specimen, Sept. 14; Valparaiso, 1 specimen, April 1.

These, except the Valparaiso specimen, are practically topotypes of the species, as are also the Simons specimens, recorded as *P. niger* by Salvin & Godman (*l. c.*).

210. Hadrostomus homochrous *Sclater.*

Two specimens, Cacagualito, May 12, and Bonda, without date.

211. Tityra semifasciata *Cabanis.*

Tityra personata SALV. & GODM. Ibis, 1880, 169. Minca.

Tityra semifasciata SCLATER, Cat. Bds. Brit. Mus. XIV, 1888, 330 (includes the Minca specimen recorded by Salvin & Godman, *l. c.*; BANGS, Proc. Biol. Soc. Wash. XII, 1898, 158 (Pueblo Viejo).

Seven specimens: Minca, June 23 and July 22; Cacagualito, June 3; Valparaiso, May 27 and June 10.

212. [Tityra albitorques *Dubus.*

Tityra albitorques SALV. & GODM. Ibis, 1880, 169. Valencia.]

213. Heteropelma veræpacis *Sclater.*

Six specimens: Bonda, 4 specimens, Feb. 9, and May 8; Cacagualito, 2 specimens, May 20 and 21.

These specimens are not distinguishable from Central American examples of this species.

A young specimen in nestling plumage has the head dull rufous brown, lighter and redder than the back, which differs from that of the adult in being slightly more rufescent. The plumage below is peculiarly soft and woolly, and strongly rufescent instead of olive as in the adult.

214. Pipreola auripectus decora *Bangs.*

Pipreola auripectus decora BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 98. Chirua.

Fourteen specimens: Valparaiso, 11 specimens, March 27–April 14, and June 13; El Libano, 3 specimens, May 5–11.

215. Manacus manacus abdivitus *Bangs.*

Chiromachæris manacus SALV. & GODM. Ibis, 1880, 169. Minca.

Manacus manacus BANGS, Proc. Biol. Soc. Wash. XII, 1898, 137. Santa Marta.

Manacus manacus abdivitus BANGS, Proc. N. Engl. Zoöl. Club, I, 1889, 35.

Thirty-four specimens, taken as follows: Bonda, 10 specimens, Jan. 5–26, Nov. 23, Dec. 12; Minca, 9 specimens, Jan. 18 and 19, July 5 and 28, Aug. 1, and Nov. 24; Cacagualito, 8 specimens, May 7–25; Donama, 2 specimens, Dec. 22; Masinga Vieja, 3 specimens, Nov. 23 and 25 and Feb. 9; Jordan, 1 specimen, May 11.

216. Chiroxiphia lanceolata (*Wagler*).

Chiroxiphia lanceolata SALV. & GODM. Ibis, 1879, 202 (Manaure); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 137 (Santa Marta).

Forty-two specimens: Bonda, 23 specimens, Feb. 9–21, May

8–10, July 2, 6, 9 and 27, Aug. 2–25, Sept. 5, Oct. 8, Nov. 1–23; Minca, 1 specimen, Aug. 3; Cacagualito, 18 specimens, May 5–27.

217. Pipra auricapilla (*Linn.*).

Pipra auricapilla SALV. & GODM. Ibis, 1880, 169 (Minca); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 137 (Santa Marta).

Twenty-eight specimens, as follows: Bonda, Jan. 7–31, Oct. 24, Nov. 24; Onaca, Dec. 30–Jan. 7; Minca, Nov. 2 and 24; Agua Dulce, April 12; Las Nubes, Dec. 2, 22 and 30; Valparaiso, March 21, April 7, May 21.

218. Dendrocolaptes validus *Tschudi.*

Eleven specimens: Valparaiso, March 7, April 5, May 27, June 14; El Libano, April 25, May 3, 6, 9, and 20; Las Nubes, Nov. 30.

219. [Dendrocincla meruloides (*Lafr.*).

Dendromanes meruloides SALV. & GODM. Ibis, 1879, 202. Manaure.]

220. Dendrocincla olivacea lafresnayi *Ridgw.*

Dendrocincla olivacea anguina BANGS, Proc. Biol. Soc. Wash. XII, 1898, 138 (Santa Marta; one specimen); *ibid.* XIII, 1899, 100 (Palomina, Chirua, and La Concepcion; one specimen each).

Seven specimens: Minca, July 28; Onaca, Jan. 4; Las Nubes, Dec. 5–7; Valparaiso, March 8 and April 1.

These specimens exactly agree with a Panama specimen in the Lawrence Collection identified as *Dendrocincla lafresnayi* Ridgw. by Mr. Ridgway.

221. Picolaptes lachrymiger (*Des Murs*).

Picolaptes lachrymiger SALV. & GODM. Ibis, 1880, 171 (San Sebastian); BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 100 (La Concepcion; one specimen).

Thirty-two specimens, collected as follows: Valparaiso, 13 specimens, March 15–29, April 4–14, May 31, June 6; El Libano, 13 specimens, April 25–May 21, and June 17; Las Nubes, 4 specimens, Dec. 1 and 12–15; San Lorenzo, 2 specimens, May 12.

222. Xiphocolaptes procerus *Cab. & Hein.*

Xiphocolaptes procerus BANGS, Proc. Biol. Soc. Wash. XII, 1898, 177. Macotama.

Eleven specimens, collected as follows: Valparaiso, 4 specimens, March 17–26, April 1, May 26; El Libano, 3 specimens, April 29, May 12, June 16; San Lorenzo, 2 specimens, May 14; Las Nubes, 2 specimens, Dec. 6 and 15.

223. Dendroplex picirostris (*Lafr.*).

Dendroplex picirostris SALV. & GODM. Ibis, 1880, 171 (Santa Marta); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 138 (Santa Marta).

Nineteen specimens, all collected at Bonda, Jan. 21, Feb. 24, June 27, July 5, Aug. 13–30, Sept. 3, Nov. 5 and 17.

224. Dendrornis nana *Lawrence.*

Dendrornis susurrans SALV. & GODM. Ibis, 1880, 171. Minca.

Two specimens, Cacagualito, May 12 and July 29.

225. Margarornis brunnescens *Sclater.*

Premnoplex brunnescens BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 100. San Miguel and Chirua.

Five specimens: El Libano, May 9–21; Las Nubes, Dec. 9; Valparaiso, March 7.

226. [Sittasomus olivaceus *Wied.*

Sittasomus olivaceus SALV. & GODM. Ibis, 1879, 202. Manaure.]

227. Sclerurus albigularis propinquus *Bangs.*

Sclerurus albigularis BANGS, Proc. Biol. Soc. Wash. XII, 1898, 177. Palomina, one specimen.

Sclerurus albigularis propinquus BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 99. Chirua, one specimen.

Eleven specimens: Las Nubes, 7 specimens, March 10–25 and April 13; Valparaiso, 4 specimens, Dec. 3–15.

This series fully establishes the characters claimed by Mr. Bangs for his subspecies *propinquus*.

228. Xenops genibarbis *Illiger.*

Xenops genibarbis SALV. & GODM. Ibis, 1880, 171 (Minca); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 138 (Santa Marta).

Four specimens: Bonda, Nov. 16; Minca, May 29 and July 24; Cacagualito, May 27.

229. Xenops rutilus *Licht.*

One specimen, Las Nubes, Dec. 14.

230. Anabazanops striaticollis (*Sclater*).

Anabazanops striaticollis BANGS, Proc. Biol. Soc. Wash. XIII, 1898, 99. Chirua, San Miguel, and La Concepcion.

Twenty-four specimens: Onaca, 1 specimen, Nov. 28; Valparaiso, 11 specimens, March 7–27, April 5, May 27 and 30, June 8; El Libano, 4 specimens, April 21, May 6–25; Las Nubes, 8 specimens, Dec. 1–20.

231. Thripadectes flammulatus (*Eyton*).

One specimen, El Libano, May 10.

232. [Automolus rufipectus *Bangs.*

Automolus rufipectus BANGS, Proc. Biol. Soc. Wash. XII, 1898, 158 (Pueblo Viejo); *ibid.* XIII, 1899, 99 (various localities, 3000 to 7500 feet).]

233. [Siptornis wyatti (*Scl. & Salv.*).

Synallaxis wyatti SALV. & GODM. Ibis, 1880, 170. Sierra Nevada, 10,000 to 12,800 feet.

Siptornis wyatti BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 99. Paramo de Chiruqua, 15,000 feet.]

234. Siptornis antisiensis (*Sclater*).

Synallaxis antisiensis SALV. & GODM. Ibis, 1880, 170.
Siptornis antisiensis BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 99. Santa Cruz, Paramo de Macotama, and Paramo de Chiruqua.

Two specimens, Valparaiso, April 4 and June 1.

235. [Synallaxis candæi *Lafr. & d'Orb.*

Synallaxis candæi SALV. & GODM. Ibis, 1880, 170. Valencia.]

236. Synallaxis cinnamomea (*Gmel.*).

One specimen, Cienaga, Sept. 8.

237. [Synallaxis fusco-rufa *Sclater.*

Synallaxis fusco-rufa SCLATER, P. Z. S. 1882, 578, pl. xliii, fig. 1 (San Sebastian); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 177 (San Miguel); *ibid.* Proc. N. Engl. Zoöl. Club, I, 1899, 79 (San Sebastian and El Mamon).]

238. [Synallaxis albescens *Temm.*

Synallaxis albescens BANGS, Proc. Biol. Soc. Wash. XII, 1898, 177. Palomina].

239. [Leptasthenura andicola *Sclater.*

Leptasthenura andicola SALV. & GODM. Ibis, 1880, 170. Sierra Nevada, altitude 10,000 feet.]

240. [Cinclodes fuscus albidiventris (*Sclater*).

Cinclodes fuscus albidiventris BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 98. Paramo de Chiruqua, altitude 15,000 feet.]

241. Furnarius agnatus *Scl. & Salv.*

Furnarius agnatus SALV. & GODM. Ibis, 1880, 170 (Valle Dupar); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 138 (Santa Marta).

Six specimens: Bonda, July 5, Aug. 1 and 29; Santa Marta, July 11.

242. Grallaricula ferrugineipectus *Sclater.*

One specimen, Las Nubes, Dec. 9.

243. [Grallaria spiator *Bangs.*

Grallaria spiator BANGS, Proc. Biol. Soc. Wash. XII, 1898, 177. Macotama, altitude 8000 feet; one specimen.]

244. Grallaria bangsi,[1] sp. nov.

Type, No. 73145, ♂ ad., El Libano, altitude 7000 feet, May 25, 1899; coll. H. H. Smith.

Above uniform dark olive brown; primaries brownish olive; under wing-coverts deep chestnut, fading to pale chestnut on base of quills; lores dull buffy whitish; throat deep ochraceous, which color descends along the median line to the abdomen as a slight ochraceous edging to the feathers; rest of the under parts dark olivaceous, nearly like the back, broadly flammulated with pale buffy white. Bill rather light horn color, very light at tip and along the edges of the commissure; feet light horn color. Wing, 91 mm.; tail, 59; tarsus, 47; culmen, 23.

[1] Named for Mr. Outram Bangs, in recognition of his valuable contributions to our knowledge of the Santa Marta ornis.

This species finds its nearest ally in *Grallaria modesta* Sclater, from Bogota, from which it differs in its deep ochraceous throat, which extends from the base of the bill to the upper breast. It is represented by two specimens, exactly similar, the type from El Libano and another specimen, ♀ ad., from San Lorenzo (altitude 7500 feet), May 23, 1899.

245. Myrmeciza boucardi *Berlepsch.*

Myrmeciza boucardi BANGS, Proc. Biol. Soc. Wash. XII, 1898, 138. Santa Marta.

Four specimens: Bonda, Nov. 10; Cacagualito, May 7 and 9.

246. Rhamphocænus rufiventris sanctæ-martæ (*Sclater*).

Rhamphocænus rufiventris sanctæ-martæ BANGS, Proc. Biol. Soc. Wash. XII, 1898, 138. Santa Marta.

Seven specimens, Bonda, Jan. 10 and 16, Aug. 2 and 18, Sept. 14, Oct. 8, and Nov. 17.

247. Formicivora intermedia *Cabanis.*

Formicivora intermedia SALV. & GODM. Ibis, 1880, 171. Santa Marta.

Eriodora intermedia BANGS, Proc. Biol. Soc. Wash. XII, 1898, 138. Santa Marta.

Fifty-seven specimens, all from Bonda, taken as follows: Jan. 11–27, Feb. 4–23, July 14, Aug. 11–27, Sept 3–6, Oct. 6–21, Nov. 23, Dec. 8 and 23.

248. Formicivora caudata *Sclater.*

Formicivora caudata BANGS, Proc. Biol. Soc. Wash. XII, 1898, 176. Palomina.

One specimen, Minca, July 25, is referred provisionally to this species.

249. Myrmotherula sanctæ-martæ, sp. nov.

Type, No. 72895, ♂ ad., Valparaiso, altitude 5500 feet, March 18, 1899; coll. H. H. Smith.

Adult male.—General color above uniform dark gray; wings dusky edged with gray, the coverts tipped with white, preceded by a distinct subapical bar of black; under wing-coverts gray; inner edge of quills whitish; tail dusky gray, almost concolor with the back, and with no trace of white on the tips of the feathers; throat black, the black area sharply defined; rest of the underparts concolor with the dorsal surface; under tail-coverts slightly tipped with whitish; bill and feet black. Wing, 52 mm.; tail, 43; tarsus, 17; culmen, 12.

Male juv.—A young male (Valparaiso, June 6) is changing from the nestling plumage to that of the adult. The remnants of the nestling plumage still present indicate that the young bird is brownish olivaceous above and ochraceous brown below, with the wings and tail rusty brown with a tinge of olivaceous, the under wing-covers, axillars and inner edges of the rectrices buffy ochraceous. No white on the outer wing-coverts and no white tipping to the tail-feathers.

This species is represented by only the two specimens above described. Its nearest ally is apparently *M. longipennis*, from which, however, it is strongly distinguished by the absence of white on the rectrices and the much darker gray of the ventral surface.

I also refer to this species a single specimen (♂ ad.) from Los Palmales, Venezuela, collected by Mr. F. W. Urich.

250. Thamnophilus doliatus (*Linn.*).

One specimen, Bonda, Oct. 1.

251. Thamnophilus pulchellus (*Cab. & Hein.*).

Thamnophilus leucauchen SALV. & GODM. Ibis, 1880, 171. Santa Marta and Valencia.

Five specimens: Bonda, Oct. 1 and 5, and Dec. 19; Cienaga, Sept. 8.

252. Thamnophilus melanonotus *Sclater*.

Thamnophilus melanonotus BANGS, Proc. Biol. Soc. Wash. XII, 1898, 138. Santa Marta.

One hundred specimens, all collected at Bonda and taken at intervals throughout the year.

253. Thamnophilus nævius (*Gmel.*).

Thamnophilus nævius SALV. & GODM. Ibis, 1880, 171 (Minca); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 138 (Santa Marta).

Eleven specimens: Bonda, Sept. 28, Oct. 8, Nov. 11 and 16; Minca, Jan. 19; Cacagualito, May 9–21; Onaca, Dec. 27 and Jan. 2.

254. [Conopophaga browni *Bangs*.

Conopophaga browni BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 100. Pueblo Viejo and Chirua, 7000 to 8000 feet.]

255. [Scytalopus sylvestris *Tacz.*

Scytalopus sylvestris BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 101. San Francisco, one specimen.]

256. Scytalopus latebricola *Bangs.*

Scytalopus latebricola BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 101. Paramo de Chiruqua and Paramo de Macotama, altitude, 10,000 to 11,000 feet.

Two specimens, Valparaiso, April 13 and June 19.

257. Cyanocorax affinis *Pelzeln.*

Cyanocorax affinis SALV. & GODM. Ibis, 1879, 201 (Valle Dupar and Atanques); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 138 (Santa Marta).

Eight specimens: Bonda, June 17, July 8 and 9; Minca, July 26; Las Nubes, Dec. 1; Onaca, Dec. 29 and 30; Cacagualito, May 15.

258. Quiscalus assimilis *Sclater.*

One specimen, Cienaga, Sept. 11.

259. [Icterus icterus (*Linn.*).

Icterus vulgaris SALV. & GODM. Ibis, 1879, 200. Valle Dupar.]

260. Icterus xanthornus (*Linn.*).

Icterus xanthornus SALV. & GODM. Ibis, 1880, 123 (Santa Marta): BANGS, Proc. Biol. Soc. Wash. XII, 1898, 138 (Santa Marta).

Fourteen specimens: Santa Marta, July 10–14; Bonda, July 6, Aug. 16–22, Nov. 12 and 29, Dec. 1.

261. Icterus mesomelas *Wagler.*

One specimen, Cacagualito, May 25.

262. Icterus auricapillus *Cassin.*

Icterus auricapillus SALV. & GODM. Ibis, 1880, 123 (Santa Marta). BANGS, Proc. Biol. Soc. Wash. XII, 1898, 139 (Santa Marta).

Eight specimens: Bonda, July 3 and 9, Aug. 17, Sept. 7, Oct. 6, Nov. 21, Dec. 6; Cacagualito, May 12.

263. [Icterus galbula (*Linn.*).

Icterus baltimore SALV. & GODM. Ibis, 1880, 123. Minca, Feb. 12.
Icterus galbula BANGS, Proc. Biol. Soc. Wash. XII, 1898, 139. Santa Marta.]

264. [Sturnella meridionalis *Sclater.*

Sturnella ludoviciana SALV. & GODM. Ibis, 1879, 201. San Sebastian.

Sturnella meridionalis BANGS, Proc. N. Engl. Zoöl. Club, I, 1900, 79. San Sebastian and El Mamon.]

265. Molothrus cassini *Finsch.*

Molothrus discolor SALV. & GODM. Ibis, 1880, 123. Arihueca.

One specimen, ♀ ad., from Cacagualito, May 29.

266. Dolichonyx oryzivorus (*Linn.*).

Two specimens: Cienaga, Sept. 12, and Bonda, Oct. 12.

267. Cassidix oryzivora (*Gmel.*).

Cassidix oryzivora SALV. & GODM. Ibis, 1879, 201 (Manaure); BANGS Proc. Biol. Soc. Wash. XII, 1898, 159 and 178 (Pueblo Viejo and Palomina).

One specimen, Valparaiso, April 19.

268. Cassicus persicus (*Linn.*).

Cassicus persicus BANGS, Proc. Biol. Soc. Wash. XII, 1898, 138. Santa Marta.

One specimen, ♂ ad., Cacagualito, May 28.

269. Ostinops decumanus (*Pall.*).

Ostinops decumanus SALV. & GODM. Ibis, 1879, 200 (San Jose and Atanques); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 177 (Palomina).

One specimen, ♂ ad., Onaca, Jan. 3.

270. Pseudochloris citrina (*Pelz.*).

One specimen, apparently a young female, taken at Onaca, Dec. 29, is provisionally referred here.

271. [Emberizoides macrourus (*Gmel.*).

Emberizoides macrurus BANGS, Proc. Biol. Soc. Wash. XII, 1898, 141 and 179 (Santa Marta, San Miguel, Macotama and Palomina.]

272. Arremonops venezuelensis *Ridgw.*

Arremonops venezuelensis BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 104. Santa Marta.

Two specimens, juv., Bonda, Oct. 24.

273. [Arremonops caneus *Bangs.*

Embernagra conirostris SALV. & GODM. Ibis, 1880, 123. Santa Marta.

Embernagra conirostris caneus BANGS, Proc. Biol. Soc. Wash. XII, 1898, 140 (in part). Santa Marta.

Arremonops caneus BANGS, *ibid.* XIII, 1899, 103. Santa Marta.]

274. [Catamenia, sp.

Catamenia, sp.? BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 102. One female, Paramo de Chiruqua, 15,000 ft.]

275. Spiza americana (*Gmel.*).

Spiza americana BANGS, Proc. Biol. Soc. Wash. XII, 1898, 140. Santa Marta.

Four specimens, Bonda, Jan. 4 and 5 and March 21.

276. Zamelodia ludoviciana (*Linn.*).

Hedymeles ludovicianus SALV. & GODM. Ibis, 1880, 122. Minca, Jan. 29.

Zamelodia ludoviciana BANGS, Proc. Biol. Soc. Wash. XII, 1898, 140. Santa Marta, winter.

Three specimens: Masinga Vieja, Nov. 23; Valparaiso, March 29.

277. [Haplospiza nivaria *Bangs.*

Phrygilus unicolor SALV. & GODM. Ibis, 1880, 122. Sierra Nevada, from 9200 to 12,800 feet.

Haplospiza nivaria BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 102. Paramo de Chiruqua, alt. 15,000 ft., at the edge of snow.]

278. Myiospiza manimbe (*Licht.*).

Myiospiza manimbe BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 103. Paramo de Macotama.

Two specimens, Bonda, Sept. 28.

279. [Brachyspiza capensis peruviana (*Less.*).

Zonotrichia pileata SALV. & GODM. Ibis, 1879, 200 (Atanques); *ibid.* 1880, 222 (San Sebastian).

Brachyspiza capensis peruviana BANGS, Proc. Biol. Soc. Wash. XII, 1898, 139 (Santa Marta); *ibid.* Proc. N. Engl. Zoöl. Club, I, 1900, 79 (San Sebastian and El Mamon).]

280. Sycalis flaveola (*Linn.*).

Sycalis flaveola SALV. & GODM. Ibis, 1880, 123. Santa Marta.

Twelve specimens: Bonda, Aug. 13, Sept. 6, Nov. 11; Cienaga, Sept. 10–14; Cacagualito, May 24.

281. [Sycalis browni *Bangs.*

Sycalis browni BANGS, Proc. Biol. Soc. Wash. XII, 1898, 139. Santa Marta.]

282. [Spinus spinescens capitaneus *Bangs.*

Chrysomitris spinescens SHARPE, Cat. Bds. Brit. Mus. XII, 1888, 196. Sierra Nevada, and San Sebastian, collected by Simons.

Spinus spinescens capitaneus BANGS, Proc. Biol. Soc. Wash. XII, 1898, 178 (San Miguel); *ibid.* Proc. N. Engl. Zoöl. Club, I, 1899, 79 (San Sebastian).]

283. Astragalinus psaltria columbianus (*Lafr.*).

Chrysomitris mexicana and *C. columbiana* BANGS, Proc. Biol. Soc. Wash. XII, 1898, 139. Santa Marta.

Six specimens: Bonda, Jan. 17 and Sept. 28; Onaca, Dec. 30; Minca, Aug. 3.

284. [Oryzoborus funereus *Sclater.*

Oryzoborus funereus SHARPE, Cat. Bds. Brit. Mus. XII, 1888, 81 (Minca); BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 102 (Chirua and La Concepcion).]

285. Cyanocompsa concreta sanctæ-martæ *Bangs.*

Cyanocompsa concreta sanctæ-martæ BANGS, Proc. Biol. Soc. Wash. XII, 1898, 139. Santa Marta.

Four specimens, Cacagualito, May 12–20.

286. Volatinia jacarini splendens (*Vieill.*).

Volatinia jacarini SALV. & GODM. Ibis, 1879, 200. San José.

Volatinia jacarini splendens BANGS, Proc. Biol. Soc. Wash. XII, 1898, 139. Santa Marta.

Thirteen specimens: Bonda, Aug. 6, 23, and 27, Sept. 28, Nov. 17; Onaca, Dec. 29; Minca, July 25; Masinga Vieja, Sept. 7; Cacagualito, May 14–21.

287. Phonipara bicolor (*Linn.*).

Two females, collected at Minca, Aug. 1, are referred to this species, but the Colombian form will doubtless prove separable when more material is received.

288. [Sporophila plumbea colombiana (*Sharpe*).

Spermophila plumbea SALV. & GODM. Ibis, 1880, 122. Santa Marta.
Spermophila plumbea colombiana SHARPE, Cat. Bds. Brit. Mus. XII, 1888, 99.]

289. Sporophila minuta (*Linn.*).

Eleven specimens: Bonda, Aug. 2, 27–29, Sept. 3; Onaca, Jan. 4; Cienaga, Sept. 9–17.

290. Sporophila gutturalis (*Licht.*).

Sporophila gutturalis BANGS, Proc. Biol. Soc. Wash. XII, 1898, 179. Palomina.

Seven specimens: Cacagualito, 6, all males, May 12–26; Onaca, 1 ♀, Jan. 2.

291. Sporophila grisea (*Gmel.*).

Spermophila grisea SHARPE, Cat. Bds. Brit. Mus. XII, 1888, 96. Santa Marta. W. W. Saunders.

One specimen, Cienaga, Sept. 8.

292. Sporophila luctuosa (*Lafr.*).

Spermophila luctuosa SALV. & GODM. Ibis, 1880, 122 (Santa Marta); BANGS, Proc. N. Engl. Zoöl. Club, I, 1899, 79 (San Sebastian and El Mamon).

One specimen, ♂ ad., Masinga Vieja, Sept. 7.

293. [Schistochlamys atra (*Gmel.*).

Schistochlamys atra BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 104. La Concepcion and San Antonio.]

294. Saltator striatipectus (*Lafr.*).

Saltator albicollis SALV. & GODM. Ibis, 1880, 122. Minca.
Saltator striatipectus BANGS, Proc. Biol. Soc. Wash. XII, 1898, 140. Santa Marta.

Five specimens: Bonda, Dec. 7 and Jan. 10; Minca, July 28 and Aug. 3 and 4.

295. Saltator magnus (*Gmel.*).

Saltator magnus SALV. & GODM. Ibis, 1880, 121 (Minca); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 140 and 178 (Santa Marta, San Miguel, and Palomina).

Three specimens: Onaca, Jan. 6; Cacagualito, May 27; Minca, July 31.

296. Saltator olivaceus *Cab.*

Saltator olivaceus SALV. & GODM. Ibis, 1880, 121. Santa Marta.

Eight specimens: Bonda, Nov. 17, Dec. 2 and 22, Jan. 5; Santa Marta, July 12 and 14.

297. Arremon schlegeli *Bonap.*

Arremon schlegeli SALV. & GODM. Ibis, 1880, 121 (Minca); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 140 (Santa Marta).

Seventeen specimens, as follows: Bonda, Oct. 12, Nov. 15; Minca, June 5 and 23, July 6, 25–28, Aug. 4; Onaca, Dec. 28; Valparaiso, May 31.

298. Buarremon basilicus *Bangs.*

Buarremon basilicus BANGS, Proc. Biol. Soc. Wash. XII, 1898, 159 (Pueblo Viejo); *ibid.* XIII, 1899, 104 (Chirua and San Francisco).

Twelve specimens, as follows: Valparaiso, 9 specimens, March 10, 14, and 25, April 12–15, May 26, June 28; El Libano, May 9, 18, and 20.

299. Buarremon assimilis (*Boiss.*).

Four specimens, Bonda, Oct. 24 (2 juv. in nestling plumage), Dec. 14 and 17 (2 adults).

The young in first plumage differ from the adults in having the black head stripes brown instead of black and the median stripe very indistinct; the olive of the back is blotched with brown; the throat is pale greenish yellow instead of white; the rest of the lower parts are olivaceous, with the breast streaked with blackish brown.

300. Buarremon melanocephalus *Salv. & Godm.*

Buarremon melanocephalus SALV. & GODM. Ibis, 1880, 121 (San Sebastian); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 178 (San Miguel, Palomina, and San Francisco); *ibid.* Proc. N. Eng. Zoöl. Club, I, 1899, 79 (San Sebastian and El Mamon).

Twelve specimens, as follows: Las Nubes, 1 specimen, Dec. 22; Valparaiso, 5 specimens, March 7 and 8, April 5 and 8, June 10; El Libano, 6 specimens, April 22, May 4–22.

301. [Nemosia pileata (*Bodd.*).

Nemosia pileata SALV. & GODM. Ibis, 1880, 121. Valencia.]

302. [Tachyphonus rufus (*Bodd.*).

Tachyphonus rufus BANGS, Proc. Biol. Soc. Wash. XII, 1898, 160 and 179 (Pueblo Viejo and Palomina).]

303. Eucometis cristata (*Du Bus*).

Eucometis cristata SALV. & GODM. Ibis, 1880, 121 (Arihueca) ; BANGS, Proc. Biol. Soc. Wash. XII, 1898, 142 (Santa Marta).

Four specimens : Bonda, Feb. 18 and Nov. 10 ; Onaca, Jan. 5 ; Cacagualito, May 9.

304. Piranga hæmalea *Salv. & Godm.*

Piranga faceta BANGS, Proc. Biol. Soc. Wash. XII, 1898, 141 (Santa Marta); *ibid.* XIII, 1899, 104 (La Concepcion and San Miguel).

Seven specimens : Bonda, Jan. 7 and Aug. 23 ; Onaca, Dec. 26 and 30 ; Minca, July 27 ; Cacagualito, May 29 ; Masinga Vieja, Sept. 7.

305. Piranga rubra (*Linn.*).

Pyranga æstiva SALV. & GODM. Ibis, 1879, 200 (Atanques, Feb. 26) ; *ibid.* 1880, 121 (Santa Marta, Dec. 27, and Minca, Jan. 16).

Piranga rubra BANGS, Proc. Biol. Soc. Wash. XII, 1898, 141 (Santa Marta, winter).

Thirty-three specimens, of which 31 are from Bonda, as follows : Bonda, Nov. 8–30, Dec. 1–28, Jan. 3–24, Feb. 23 ; Onaca, Jan. 8 ; Valparaiso, March 17.

Three of the males (Nov. 17 and 22 and March 17) are in full adult dress ; six others (Dec. and Jan.) are molting into the red plumage, but many others, evidently young males, show no signs of molt.

306. Ramphocelus dimidiatus (*Lafr.*).

Ramphocælus dimidiatus SALV. & GODM. Ibis, 1880, 120 (San Antonio) ; BANGS, Proc. Biol. Soc. Wash. XII, 1898, 141, 159, and 179 (Santa Marta, Pueblo Viejo, Palomina, and San Miguel).

Fifteen specimens, Cacagualito, May 5–June 2.

307. Tanagra cyanocephala auricrissa (*Sclater*).

Two specimens : Valparaiso, April 1 ; El Libano, May 11.

308. Tanagra palmarum melanoptera (*Hartl.*).

Tanagra palmarum SALV. & GODM. Ibis, 1880, 120. Minca.
Tanagra palmarum melanoptera BANGS, Proc. Biol. Soc. Wash. XII, 1898, 141. Santa Marta.

Three specimens : Cacagualito, May 20 and June 2 ; Bonda, Aug. 30.

309. Tanagra cana *Swains.*

Tanagra cana SALV. & GODM. Ibis, 1880, 120 (Santa Marta) ; BANGS, Proc. Biol. Soc. Wash. XII, 1898, 141 (Santa Marta).

Eighteen specimens : Bonda, 17 specimens, Feb. 18, July 13, Aug. 4–20, Sept. 8, Oct. 20–22, Nov. 2–29, Dec. 9–17 ; Cacagualito, 1 specimen, May 27.

310. Pœcilothraupis melanogenys *Salv. & Godm.*

Pœcilothraupis melanogenys SALV. & GODM. Ibis, 1880, 120, pl. iii. (near San Sebastian, 8000 ft., June 22) ; BANGS, Proc. Biol. Soc. Wash. XII, 1898, 179 (Macotama) ; *ibid.* XIII, 1899, 104 (alt. 7,500–12,000 ft.).

Eleven specimens : El Libano (6000 ft.), April 22, May 18–21 ; San Lorenzo (7000 ft.), May 2–13.

311. Calospiza desmaresti (*Gray*).

Calliste desmaresti SALV. & GODM. Ibis, 1880, 120. Minca and Guallabal, alt. 3000 ft.
Calospiza desmaresti BANGS, Proc. Biol. Soc. Wash. XII, 1898, 159 and 179. Santa Marta and Pueblo Viejo.

Forty-nine specimens, as follows : Bonda, 20 specimens, Sept. 29 ; Agua Dulce, 2 specimens, April 12 ; Onaca, 17 specimens, Dec. 2–20 ; Cacagualito, 1 specimen, May 19 ; Valparaiso, 9 specimens, March 13, 29, and 30, and April 3–14.

312. Calospiza atricapilla (*Lafr.*).

Twenty-two specimens : Valparaiso, 20 specimens, March 25–April 12, May 24 and 26, June 8 and 17 ; Las Nubes, 2 specimens, Dec. 17 and 20. The series contains only one female and one ♂ juv., 20 of the 22 specimens being adult males.

It seems strange that this species should not have been taken by Mr. Brown, and that *C. cyanoptera* should have been taken by both Mr. Simon and Mr. Brown and not by Mr. Smith's collectors.

313. [Calospiza cyanoptera (*Swains.*).

Calliste cyanoptera SALV. & GODM. Ibis, 1879, 200 (San José and Atanques); *ibid.* 1880, 120 (Minca).

Calospiza, sp. BANGS, Proc. Biol. Soc. Wash. XII, 1898, 141. Santa Marta.

Calospiza cyanoptera BANGS, Proc. Biol. Soc. Wash. XII, 1898, 159 and 179. Pueblo Viejo, Palomina, and San Miguel.]

314. Euphonia crassirostris *Sclater.*

Euphonia laniirostris SALV. & GODM. Ibis, 1879, 199 (Atanques, alt. 2700 ft.); *ibid.* 1880, 119 (Santa Marta and Minca).

Euphonia crassirostris BANGS, Proc. Biol. Soc. Wash. XII, 1898, 141 and 179. Santa Marta and Palomina.

Sixty-eight specimens, as follows: Bonda, 57 specimens, Jan. 5–17, June 16 and 22, July 13, Aug. 3–22, Sept. 13, Oct. 7 and 8, Nov. 9–25, Dec. 6 and 8; Onaca, 2 specimens, Jan. 6; Minca, 4 specimens, July 22–31; Cacagualito, 5 specimens, May 10–16, June 3.

Euphonia crassirostris is smaller than *E. laniirostris*, to which it has often been referred, and the adult males are much less deeply colored throughout, especially below, where the yellow is a light clear yellow and not the deep, almost gamboge yellow of *E. laniirostris.* There is a corresponding difference in the olive green of the young males and females. (See further on this point, this 'Bulletin,' Vol. III, 1891, p. 351.)

315. Euphonia trinitatis *Strickl.*

Euphonia trinitatis BANGS, Proc. Biol. Soc. Wash. XII, 1898, 141. Santa Marta.

Twenty-six specimens, Bonda, Jan. 13 and 17, June 28, July 13, Aug. 5–27, Sept. 2–13, Oct. 3–11, Nov. 8–13.

316. Chlorophonia frontalis *Sclater.*

Chlorophonia frontalis SALV. & GODM. Ibis, 1879, 199 (Valley of Chinchicua and San José); BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 104 (Chirua, La Concepcion, and San Miguel); *ibid.* Proc. N. Engl. Zoöl. Club, I, 1899, 80 (San Sebastian.)

Forty-five specimens: Onaca, 11 specimens, Dec. 31 and Jan. 5–8; Las Nubes, 17 specimens, Dec. 8–20; Valparaiso, 16 specimens, April 1–7, March 13–30; El Libano, 1 specimen, May 8.

317. Stelgidopteryx uropygialis (*Lawr.*).

Stelgidopteryx uropygialis BANGS, Proc. Biol. Soc. Wash. XII, 1898, 142. Santa Marta.

Eleven specimens, Bonda, Jan. 18, July 1, Sept. 6 and 7 (in molt), Oct. 11, Nov. 9 and 29, Dec. 15, and Jan. 18.

318. [Atticora cyanoleuca (*Vieill.*).

Atticora cyanoleuca BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 105. La Concepcion, alt. 3000 ft.]

319. Cyclarhis flavipectus canticus *Bangs.*

Cyclorhis flavipectus SALV. & GODM. Ibis, 1880, 119. Valencia.
Cyclarhis flavipectus canticus BANGS, Proc. Biol. Soc. Wash. XII, 1898, 142. Santa Marta.

Eleven specimens, Bonda, Jan. 6 and 18, June 30, Aug. 10, 15, and 31, Sept. 5 and 8, Nov. 18 and 30, and Dec. 19.

In addition to the features given by Mr. Bangs for this form, it may be noted that the Santa Marta specimens have the abdomen and lower tail-coverts much more strongly suffused with buff than Trinidad and Venezuela (Cumaná) examples.

320. Hylophilus brunneus, sp. nov.

Type, No. 70572, ♀ ad., Las Nubes, alt. 5000 ft., Dec. 14, 1898; coll. H. H. Smith.

Front, lores and cheeks brownish ochraceous, darker on the pileum and passing gradually on the nape into the olivaceous gray of the rest of the dorsal surface; outer wing-coverts and quills fuscous, externally broadly margined with ochraceous brown; inner webs broadly margined with pale ochraceous; under wing-coverts deep ochraceous; rectrices fuscous broadly margined with rusty brown; throat and breast brownish ochraceous; rest of under parts olivaceous brown; bill black above, lighter below, especially at base; feet grayish black. Wing, 55 mm.; tail, 42; tarsus, 16; culmen, 13.

This species is very different from all the other members of the genus, through the dull olivaceous gray dorsal surface, ochraceous throat and breast, and olive brown underparts. It is represented by two adult females, taken as follows: Las Nubes, Dec. 14 (type), and Valparaiso, March 18. The color of the lower parts very closely resembles that of the female of *Diglossa albilateralis*.

321. Hylophilus flavipes *Lafr.*

Hylophilus flavipes BANGS, Proc. Biol. Soc. Wash. XII, 1898, 142. Santa Marta.

Thirty-nine specimens, all from Bonda, collected as follows: Jan. 9–28, Feb. 3–24, July 9, Aug. 6–31, Sept. 6, Oct. 22.

Vireo acuticauda Lawrence, usually synonymized with *Hylophilus aurantiirostris*, is referable to *H. flavipes*, as shown by comparison of the type with the present large series of both *H. aurantiirostris* and *H. flavipes.*

Hylophilus viridiflavus Lawrence, from Panama, while closely allied to *H. flavipes*, is so different from it as apparently to warrant its recognition as specifically distinct.

322. Hylophilus aurantiifrons *Lawr.*

Hylophilus hypoxanthus SALV. & GODM. Ibis, 1880, 118 (not of Pelzeln). Valencia.

Hylophilus aurantiifrons BANGS, Proc. Biol. Soc. Wash. XII, 1898, 142. Santa Marta.

Seven specimens, Bonda, Jan. 11 and 21, Aug. 3, Nov. 8 and 17.

The name *Hylophilus hypoxanthus* Pelzeln (*Hylophilus aurantiirostris hypoxanthus*) may well be retained for the form found in Trinidad, and on the adjoining Venezuelan coast, Guiana, etc., which differs from true *aurantiirostris* from Panama and the northern coast region of Colombia and Venezuela in having a distinct buffy or ochraceous suffusion over the whole pectoral region, but deepest on the sides of the breast.

323. Vireo josephæ *Sclater.*

Vireo josephæ BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 105. One specimen, El Paramo de Macotama, alt. 11000 ft.

Ten specimens: Valparaiso, April 4; El Libano, April 25 and 28, and May 6, 9, and 12; Las Nubes, Dec. 6–10.

324. Vireo chivi agilis (*Licht.*).

Vireo chivi agilis BANGS, Proc. Biol. Soc. Wash. XII, 1898, 142. Santa Marta.

Fifty specimens, all taken near Bonda, as follows: Bonda, 44 specimens, Jan. 17, 23, and 26, Feb. 8–17, June 25–29, July 8

Aug. 9–30, Sept. 5, Oct. 8, Nov. 23; Minca, July 27 and Aug. 4; Santa Marta, July 1; Quebra Concha, Aug. 18; Cacagualito, May 19.

325. Vireo flavifrons *Vieill.*

Vireosylvia flavifrons SALV. & GODM. Ibis, 1880, 118. Minca, Feb. 13.

One specimen, Onaca, Dec. 28.

326. Vireo flavoviridis (*Cassin*).

Seven specimens, Bonda, Aug. 12 and 25, Sept. 13, Oct. 4–13.

327. [Vireo olivaceus (*Linn.*).

Vireosylvia olivacea SALV. & GODM. Ibis, 1880, 118. Santa Marta, April 3.]

328. Vireo calidris barbatula (*Baird*).

Eleven specimens, Bonda, Aug. 17–Sept. 18.

329. Procnias viridis *Ill.*[1]

Procnias tersa SALV. & GODM. Ibis, 1879, 199 (Manaure); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 179 (Palomina, San Miguel, and San Francisco).

Nine specimens: Minca, June 6–28 and July 26; Valparaiso, April 5 and 14, and June 30.

330. Cœreba luteola (*Licht.*).

Certhiola luteola SALV. & GODM. Ibis, 1880, 119. Santa Marta.

Three specimens: Cacagualito, May 12; Santa Marta, July 10; Cienaga, Sept. 15.

331. Cyanerpes cæruleus microrhynchus (*Berl.*).

Cæreba cærulea SALV. & GODM. Ibis, 1880, 119. Minca.

Arbelorhina cærulea microrhyncha BANGS, Proc. Biol. Soc. Wash. XII, 1898, 143. Santa Marta.

Fifty-four specimens, as follows: Bonda, 44 specimens, Nov. 29, Jan. 6–Feb. 8; Minca, July 5, 16, 27, and Aug. 1; Onaca, Dec. 29; Las Nubes, Dec. 15; Cacagualito, May 30.

332. Cyanerpes cyanea eximea (*Berl.*).

Cæreba cyanea SALV. & GODM. Ibis, 1879, 199 (Manaure, alt. 4000 ft.); *ibid.* 1880, 119 (Minca.)

Arbelorhina cyanea eximea BANGS, Proc. Biol. Soc. Wash. XII, 1898, 143. Santa Marta.

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[1] *Cf.* Allen, this Bulletin, II, pp. 69, 70, March, 1889.

Sixty-two specimens, as follows: Bonda, 39 specimens, Jan. 11–26, Feb. 2–9, May 11, Aug. 14–Sept. 1, Oct. 7–14, Nov. 20, Dec. 10; Cacagualito, 19 specimens, May 5–30; Minca, 4 specimens, July 25–Aug. 3.

333. Dacnis napæa *Bangs.*

Dacnis napæa Bangs, Proc. Biol. Soc. Wash. XII, 1898, 143. Santa Marta.

Eight specimens: Bonda, Aug. 19 and Jan. 15–19; Cacagualito, May 12 and June 1.

334. Dacnis plumbea (*Lath.*).

Two specimens, Sept. 14.

335. [Conirostrum rufum *Lafr.*

Conirostrum rufum Bangs, Proc. Biol. Soc. Wash. XIII, 1899, 105. Paramo de Chiruqua and Paramo de Macotama.]

336. [Diglossa sittoides similis (*Lafr.*).

Diglossa sittoides similis Bangs, Proc. Biol. Soc. Wash. XII, 1898, 179 (San Miguel); *ibid.* Proc. N. Engl. Zoöl. Club, I, 1899, 80 (San Sebastian and El Mamon).]

337. [Diglossa aterrima (*Lafr.*).

Diglossa aterrima Salv. & Godm. Ibis, 1880, 119. Sierra Nevada de Santa Marta, 10,000–11,000 ft.

I include this species in the belief that if the specimens had been what Mr. Bangs has since described as *D. nocticolor* they could not have been referred by these authors to *D. aterrima.*]

338. Diglossa nocticolor *Bangs.*

Diglossa nocticolor Bangs, Proc. Biol. Soc. Wash. XII, 1898, 180. Macotama, 8000 ft.

This fine species is represented by a single specimen, ♂ ad., collected at El Libano in May.

339. Diglossa albilateralis *Lafr.*

Diglossa albilateralis Salv. & Godm. Ibis, 1880, 119 (near San Sebastian); Bangs, Proc. Biol. Soc. Wash. XII, 1898, 179 (San Miguel); *ibid.* Proc. N. Engl. Zoöl. Club, I, 1899, 80 (San Sebastian and El Mamon).

Five specimens: El Libano, April 22, May 2 and 17; Las Nubes, Dec. 13.

340. Basileuterus cinereicollis *Sclater.*

Basileuterus conspicillatus SALV. & GODM. Ibis, 1880, 117. Two females, San José, types of the species.

Basileuterus cinereicollis BANGS, Proc. Biol. Soc. Wash. XII, 1898, 160 and 180. Pueblo Viejo, San Francisco, and Palomina.

Thirty-eight specimens : Las Nubes, Nov. 20 and Dec. 1–14 ; Onaca, Nov. 28–Dec. 14 ; Valparaiso, March 8–30, April 6 and 17, May 21–31, June 9 ; El Libano, April 22, May 6, 12, 21, and 30.

This series of 38 specimens of *Basileuterus cinereicollis* presents a vast amount of variation in the color of the central crown patch, which, in the Valparaiso series of 18 March specimens, varies from clear yellow through yellow more or less tinged with ashy at the surface to deep brownish orange ; in the greater part of the specimens the crown patch is decidedly orange rather than yellow, and in many of the specimens the orange is quite as intense and pure as in *B. coronatus.* That this variation is not due to season is evident from the period (three weeks) covered by this series ; in fact, some of the specimens showing the greatest difference in the color of the crown patch were collected within a few days of each other. Again, the difference is not sexual, as yellow-crowned and orange-crowned specimens seem to occur with about equal frequency in each sex. It may be due to age, young birds having a yellow crown patch and old birds an orange crown patch. This is indicated by the fact that a large proportion of the specimens collected in November and December have the crown yellow, or yellow more or less tinged with orange. (In many specimens the tips of the crown feathers are obscured by ashy, whether taken in fall or spring.)

Basileuterus cinereicollis was described by Sclater in 1864 (P. Z. S., 1864, p. 166) from a single specimen from Bogota, and a second specimen was received the next year from the same locality (P. Z. S., 1865, p. 285, pl. ix, fig. 2). These were the only specimens known to Mr. Sharpe (Cat. Bds. Brit. Mus., X, 382) in 1885.

Basileuterus conspicillatus Salvin & Godman was described (Ibis, 1880, 117) from two females collected at San José, Sierra Nevada de Santa Marta, in June. These two specimens appear to be the only specimens known to Mr. Sharpe (*l. c.*) in 1885.

The alleged difference between the two forms consists in the color of the crown patch, which in *B. cinereicollis* is yellow and in *B. conspicillatus* orange. Both forms are obviously represented in the present Santa Marta series, with also every stage of intergradation between them. I have accordingly adopted the earlier name *cinereicollis* in place of *conspicillatus*.

341. Basileuterus cabanisi *Berl.*

Basileuterus cabanisi SALV. & GODM. Ibis, 1880, 117 (Minca); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 144 (one specimen, Santa Marta).

Eight specimens: Minca, July 20; Las Nubes, Dec. 3; Onaca, Nov. 28 and Dec. 28–Jan. 4.

342. Basileuterus mesochrysus *Sclater.*

Basileuterus mesochrysus SALV. & GODM. Ibis, 1879, 198 (Manaure); *ibid.* 1880, 117 (Chirua); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 144 and 180 (Santa Marta and Palomina).

Eleven specimens: Bonda, Aug. 23; Minca, June 22, July 22–28, Nov. 24; Cacagualito, May 17–28.

343. Setophaga flavivertex *Salvin.*

Setophaga flavivertex BANGS, Proc. Biol. Soc. Wash. XII, 1898, 180. Macotama.

Seven specimens, El Libano, April 22–28, May 11 and 12.

344. Setophaga verticalis *d'Orb. & Lafr.*

Setophaga verticalis SALV. & GODM. Ibis, 1880, 118 (San Sebastian); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 180 (San Miguel); *ibid.* Proc. N. Engl. Zoöl. Club, I, 1899, 80 (San Sebastian and El Mamon).

Ten specimens: Las Nubes, Nov. 29–Dec. 10; Valparaiso, March 13 and 23; El Libano, May 2.

345. Setophaga ruticilla (*Linn.*).

Setophaga ruticilla SALV. & GODM. Ibis, 1879, 199; 1880, 118 (Atanques, Feb. 26, and Minca, Jan. 15–18); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 144 (Santa Marta).

Fourteen specimens: Bonda, Sept. 2 and 27, Nov. 12 and 16, Jan. 2 and 10; Valparaiso, March 11–30.

346. [Geothlypis philadelphia (*Wils.*).

Geothlypis philadelphia BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 105. Ten specimens, Chirua and La Concepcion, Feb. 12–March 25.]

347. Geothlypis agilis (*Wils.*).

One specimen, Bonda, Oct. 22.

This is apparently the first 'winter' record for this species.

348. Geothlypis formosa (*Wils.*).

Geothlypis formosa BANGS, Proc. Biol. Soc. Wash. XII, 1898, 144. One specimen, Santa Marta, winter.

Five specimens, Bonda, Oct. 7 and 8, and Nov. 10 and 24.

349. Seiurus noveboracensis (*Gmel.*).

Seiurus noveboracensis SALV. & GODM. Ibis, 1880, 116 (Minca); BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 105 (La Concepcion, March 17, and Chirua, Feb. 7).

Five specimens: Bonda, Sept. 8, Oct. 22 and 25, and Nov. 5; Cienaga, Sept. 14.

350. [Seiurus noveboracensis notabilis *Ridgw.*

Seiurus noveboracensis notabilis BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 105. Chirua, Feb. 7.]

351. Seiurus motacilla (*Vieill.*).

Seiurus motacilla BANGS, Proc. Biol. Soc. Wash. XII, 1898, 143. Santa Marta.

One specimen, Bonda, Nov. 8.

352. Dendroica æstiva (*Gmel.*).

Dendrœca æstiva SALV. & GODM. Ibis, 1880, 117 (Minca, Jan. 24); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 143 (Santa Marta).

Twenty-nine specimens, Bonda, Aug. 27–Jan. 31.

353. Dendroica striata (*Forst.*).

Thirty-one specimens, all from Bonda, collected Oct. 7–Nov. 22.

354. Dendroica castanea (*Wils.*)

One ♂ juv., Bonda, Oct. 27.

355. Dendroica cærulescens (*Gmel.*).

One adult male, Las Nubes, Dec. 16.

356. Dendroica blackburniæ (*Gmel.*).

Six specimens: Las Nubes, Dec. 10–13; Valparaiso, March 24 and 29.

357. Compsothlypis pitiayumi pacifica (*Berl.*).

Parula pitiayumi SALV. & GODM. Ibis, 1880, 117. Minca.

Compsothlypis pitiayumi pacifica BANGS, Proc. Biol. Soc. Wash. XII, 1898, 143. Santa Marta.

Three specimens: Onaca, Dec. 31; Valparaiso, April 1 and 13.

358. Helminthophila peregrina (*Wils.*).

Helminthophaga peregrina SALV. & GODM. Ibis, 1880, 117. Minca, Jan. 14 and 17, and March 26.

Helminthophila peregrina BANGS, Proc. Biol. Soc. Wash. XII, 1898, 143. Santa Marta.

Eleven specimens: Bonda, Nov. 3; Onaca, Dec. 29 and Jan. 7; Las Nubes, Dec. 1–22; Valparaiso, March 17 and April 4.

359. Helminthophila chrysoptera (*Linn.*).

Helminthophaga chrysoptera SALV. & GODM. Ibis, 1880, 117. Minca, Feb. 8.

Helminthophila chrysoptera BANGS, Proc. Biol. Soc. Wash. XII, 1898, 160. Pueblo Viejo, March 20.

Three specimens: Bonda, Sept. 6 and Oct. 3; Las Nubes, Dec. 7.

360. [Helminthophila pinus (*Linn.*).

Helminthophila pinus BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 105. One male, Chirua, March 21.]

361. Protonotaria citrea (*Bodd.*).

Thirty-seven specimens, all from Bonda, collected as follows: Oct. 8–12, Nov. 12–22, Dec. 1–12, Jan. 10–30.

362. Mniotilta varia (*Linn.*).

Mniotilta varia SALV. & GODM. Ibis, 1880, 117 (Minca, Jan. 14 and 17 and March 26); BANGS, Proc. Biol. Soc. Wash. XII, 1898, 143 (Santa Marta).

Six specimens: Bonda, Aug. 21 and Sept. 29; Las Nubes, Dec. 21; Onaca, Dec. 29 and Jan. 4.

363. [Troglodytes monticola *Bangs.*

Troglodytes monticola BANGS, Proc. Biol. Soc. Wash. XII, 1898, 106. Paramo de Chiruqua and Paramo de Macotama, alt. 11,000–15,000 ft.]

364. Troglodytes musculus rufulus (*Cab.*).

Troglodytes tessellatus SALV. & GODM. Ibis, 1879, 198 (Marocaso); *ibid.* 1880, 117 (Santa Marta).

Troglodytes rufulus SHARPE, Cat. Bds. Brit. Mus. VI, 1881, 258, in part,—the reference to the above-mentioned Santa Marta specimens.

A series of 8 specimens is provisionally referred to this subspecies, taken as follows: Minca, June 21; Cacagualito, May 16 and 17 (4 specimens, 1 juv. in first plumage); Cienaga, Sept.; Bonda, June 22 (juv.) and Oct. 8; Minca, June 21.

These examples agree very well with examples from Trinidad, in several instances specimens from the two localities being practically indistinguishable. The Trinidad specimens are apparently strictly referable to the type form of *rufulus* from Guiana. Mr. Sharpe (*l. c.*) also considers British Guiana (Bartica Grove) specimens "identical with the Santa Marta race."

365. Thryothorus lætus *Bangs.*

Thryothorus lætus BANGS, Proc. Biol. Soc. Wash. XII, 1898, 160 and 180 (Pueblo Viejo and Palomina).

Six specimens: Onaca, Dec. 20, ad.; Cacagualito, May 28 and 29, ad. and juv. in first plumage; Minca, July 6, 22, and 26, 2 ad. and 1 juv.

The young in first plumage has the head nearly concolor with the back, which latter is similar in color to that of the adult; the throat is dull grayish brown, almost without black spotting; the breast is buffy olivaceous brown, without spotting, and the rest of the lower surface is nearly uniform dull olive brown with a tinge of buff. The young appear to molt directly from this plumage into that of the adult.

366. Thryophilus rufalbus castanonotus (*Ridgw.*).

Thryophilus rufalbus SALV. & GODM. Ibis, 1880, 116. Minca.

Thryophilus minlosi BANGS, Proc. Biol. Soc. Wash. XII, 1898, 144 (not of Berlepsch). Santa Marta.

Ten specimens, collected as follows: Cacagualito, May 7–June 2; Bonda, March 15 and Nov. 24; Minca, July 31.

These specimens agree well with specimens from Panama, on the one hand, and with examples from Cumanacoa, Venezuela, on the other. The *Thryophilus minlosi* Berlepsch, from Bucara-

manga, is a much paler bird, more like *T. sinaloa* Baird, as shown by the original description and figure, and it is also from a very different faunal district.

367. [Henicorhina anachoreta *Bangs.*

Henicorhina anachoreta BANGS, Proc. N. Engl. Zoöl. Club, I, 84, Dec. 17, 1899. El Paramo de Chiruqua, between 11,000 and 12,000 feet altitude.]

368. Henicorhina leucophrys (*Tschudi*).

Henicorhina leucophrys BANGS, Proc. Biol. Soc. Wash. XII, 1898, 160 and 181. Pueblo Viejo, San Francisco, Palomina, and San Miguel.

Seventeen specimens, collected as follows: Valparaiso, Dec. 3–17; El Libano, May 4 and 12.

369. Microcerculus marginatus (*Sclater*).

Microcerculus marginatus BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 107. Chirua, one specimen.

I refer provisionally to this species a single specimen from Onaca, collected Jan. 7, 1899.

370. Heleodytes nuchalis (*Cab.*).

One specimen, Cienaga, Sept. 16.

371. Heleodytes griseus (*Swains.*).

Camplorhynchus griseus SALV. & GODM. Ibis, 1880, 116. Santa Marta.

Nine specimens, as follows: Santa Marta, July 14; Cacagualito, May 24; Bonda, July 6, 7, and 14, Aug. 16, Nov. 29, and Dec. 5.

The young, only a few weeks from the nest, closely resemble the adults; the females differ from the males in having the head dark rufous brown instead of black, the whole top of the head being also much lighter than the mantle.

372. Donacobius atricapillus (*Linn.*).

Three specimens, Cienaga, Sept. 16.

373. Mimus gilvus columbianus (*Cab.*).

Mimus gilvus SALV. & GODM. Ibis, 1880, 116. Santa Marta.

Mimus gilvus columbianus BANGS, Proc. N. Engl. Zoöl. Club, I, 1899, 80. San Sébastian and El Mamon.

Six specimens, as follows: Bonda, Nov. 11 and 30, Dec. 1 and 19, and Feb. 8; Cienaga, Sept. 13.

374. [Cinclus rivularis *Bangs.*

Cinclus rivularis BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 105. Chirua and Paramo de Chiruqua, alt. 7000–12,000 ft.]

375. [Polioptila nigriceps *Baird.*

Polioptila nigriceps SALV. & GODM. Ibis, 1880, 116. Valencia.]

376. Polioptila bilineata (*Bon.*).

Polioptila bilineata BANGS, Proc. Biol. Soc. Wash. XII, 1898, 144. Santa Marta.

One specimen, Bonda, Sept. 18.

377. [Platycichla flavipes carbonaria (*Licht.*).

Platycichla flavipes carbonaria BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 108. Chirua, La Concepcion, and San Miguel.]

378. Merula olivatra (*Lafr.*).

Merula olivatra BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 107. La Concepcion.

Eight specimens, taken as follows: Valparaiso, March 25–April 11; Las Nubes, Dec. 10.

The females wholly lack the black on the throat and breast and have the head brown, nearly concolor with the back, thus entirely lacking the black head of the males. In some females the throat and breast feathers are more or less edged with dusky. In young males the black feathers of the throat and breast are more or less edged with olive brown.

379. [Merula incompta *Bangs.*

Merula incompta BANGS, Proc. Biol. Soc. Wash. XII, 1898, 144. Santa Marta.]

380. [Merula gigas cacozela *Bangs.*

Turdus gigas SALV. & GODM. Ibis, 1879, 198. San Sebastian.

Merula gigas cacozela BANGS, Proc. Biol. Soc. Wash. XII, 1898, 181 (Macotama); *ibid.* XIII, 1899, 107 (San Miguel, Paramo de Chiruqua, and Paramo de Macotama); *ibid.* Proc. N. Engl. Zoöl. Club, I, 1899, 80 (San Sebastian and El Mamon).]

381. Merula grayi lurida (*Bon.*).

Turdus grayi SALV. & GODM. Ibis, 1880, 115. Santa Marta.

Fifteen specimens, Bonda, taken as follows: June 23, July 5

(juv.) and 14, Aug. 2 and 3 (2 juv.), Sept. 18, Dec. 8–10, Feb. 25. The series contains 3 young specimens in spotted plumage.

This species is apparently resident in the coast district, but is probably absent from the region above 5000 feet, as no specimens were taken there by Mr. Smith's collectors, nor is it included in Mr. Bangs's list of the species obtained by Mr. Brown.

The present series indicates the necessity of recognizing Bonaparte's *Planesticus luridus* as at least a well-marked subspecies of *M. grayi*. Only one of the 12 specimens at all closely resembles true *grayi*, which is perhaps sufficient to imply their probable intergradation.

382. Merula albiventris fusa *Bangs.*

Merula albiventris fusa BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 107. Chirua (type locality), La Concepcion, San Miguel, and San Francisco.

Six specimens, Bonda, Dec. 16 and 22, Jan. 20, Feb. 22, and Aug. 1.

383. Merula phæopyga minuscula *Bangs.*

Merula phæopyga minuscula BANGS, Proc. Biol. Soc. Wash. XII, 1898, 181 (Palomina and Pueblo Viejo); *ibid.* XIII, 1899, 108 (La Concepcion and San Miguel).

Seven specimens: Valparaiso, 6 specimens, all adult, March 9–29 and June 6. Also a single specimen partly in first (nestling) plumage, Bonda, Aug. 27.

In this specimen the feathers of the head, neck, interscapulars, scapulars, and wing-coverts have narrow ochraceous shaft-lines, broadening at the tip of the feather on the scapulars and wing-coverts, particularly on the latter, where they take the form of wedge-shaped spots. The breast feathers are buff, broadly tipped with blackish, and the abdominal region has narrow indistinct dusky cross-bars. The bill is deep black, faintly brownish at the base of the lower mandible.

384. Hylocichla fuscescens (*Steph.*).

Three specimens, Bonda, Oct. 5, 7, and 13.

385. Hylocichla ustulata swainsoni (*Cab.*).

Turdus swainsoni SALV. & GODM. Ibis, 1880, 115. Minca, Jan. 22.

Hylocichla ustulata swainsoni BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 107. Chirua, Feb. 16.

Two specimens, Bonda, Nov. 5 and January.

386. Hylocichla aliciæ (*Baird*).

Turdus aliciæ BANGS, Proc. Biol. Soc. Wash. XII, 1898, 144. Santa Marta.

Sixteen specimens, as follows: Bonda, Oct. 7–Nov. 28; Las Nubes, Dec. 17; Onaca, Dec. 26 and 28; Valparaiso, March 18 and 23 and April 7.

This is evidently a winter resident, arriving early in October and remaining till into April.

387. Catharus fuscater (*Lafr.*).

Catharus fuscater BANGS, Proc. Biol. Soc. Wash. XIII, 1899, 108. Chirua.

Nine specimens, El Libano, April 29–May 2.

The males are darker throughout than the females, with a much blacker head.

388. [Catharus aurantiirostris (*Hartlaub*).

Catharus aurantiirostris BANGS, Proc. Biol. Soc. Wash. XII, 1898, 160 and 181. Pueblo Viejo and Palomina.]

ADDITIONS AND CORRECTIONS.

Since the separates of this paper were printed and distributed my attention has been kindly called by Mr. Outram Bangs to a number of typographical errors and several omissions which I take this early opportunity to correct. One species (*Gallinago jamesoni*) is added to the list and one is removed, namely, *Helianthea* sp. (p. 139), as explained below, leaving the total number of species in the list as before.

Page 118, line 8 from bottom, for E. O. Bangs read E. A. Bangs.

Page 119, add to the list of papers there given the following:

1899. BANGS, OUTRAM. The Gray-breasted Wood Wrens of the Sierra Nevada de Santa Marta. *Proc. N. Engl. Zoöl. Club*, I, pp. 83, 84. Dec. 27, 1899.

This paper is cited, however, at p. 180, under *Henicorhina anchorita*.

Page 121, under No. 20 of the first list, for *Grallaria spiator* read *Grallaria spatiator*. Also make same correction on p. 159, under No. 243.

Page 121, No. 16, for *Manacus manacus abdivitus* read *Manacus manacus abditivus*. Also make the same correction on p. 155, under No. 215.

Page 121. To the list of species described as new add *Grallaria bangsi*.

Page 126. Add:

23*a* Gallinago jamesoni (*Bonap.*).

Gallinago jamesoni SHARPE, Cat. Bds. Br. Mus. XXIV, 1896, 661. "Sierra Nevada, U. S. Colombia, Aug. 18 (F. A. Simons)."

Page 139. Substitute for the remarks under No. 124, and for No. 125, **Helianthea** sp. the following:

Seven specimens, 2 adult males, 3 young males and 2 females, El Libano, April 25 and 27, and May 1, 12 and 14. The three young males have the rectrices broadly tipped with dusky bronze, and the feathers of the abdomen are edged with buff. The females have not been previously described, having been incorrectly recorded under No. 125 as probably "females of some species of *Helianthea*." They may be recognized by the following description:

Above uniform shining golden green; lores and entire under surface deep cinnamon rufous, many of the feathers on the sides of the neck, sides of the breast and (more sparingly) on the flanks tipped with golden green; lower tail-coverts a little paler and faintly blotched with dusky; wings brownish black with a purplish reflection, the outer primary edged with buff; wing-coverts, including the greater primary coverts, green like the back; tail bronzy green, the apical third blackish, tipped with buffy white, the tipping increasing in length from the middle to the outer feathers, which have a buffy tip 5 mm, long. Bill black; feet dusky flesh-color. Length, 178; wing, 67; tail, 40; tarsus, 4; bill, 30. Tarsus feathered; tail forked, the outer feathers 7 mm. longer than the inner.

I am indebted to Mr. Bangs for the suggestion that the two female Hummingbirds recorded as "124. *Helianthea* sp." might be females of the preceding species, *Leucuria phalerata*. A re-examination of them leaves no doubt that such is the case. The buffy edging of the ventral feathers in the young males is a link in the chain of evidence.

Page 173, under No. 330, add:

Cœreba luteola BANGS, Proc. Biol. Soc. Wash. XII, 1898, 143. Santa Marta.

Page 173, under No. 329, correct the reference to Bangs to read:

Procnias tersa occidentalis BANGS, Proc. Biol. Soc. Wash. XII, 179.

Page 178, under No. 361, add:

Protonotaria citrea BANGS, Proc. Biol. Soc. Wash. XII, 1898, 143. Santa Marta.

Sept. 17, 1900. J. A. ALLEN.

Article XV.—NOTE ON THE GENERIC NAMES DIDELPHIS AND PHILANDER.

By J. A. ALLEN.

Mr. James A. G. Rehn, in the 'American Naturalist' for July, 1900 (Vol. XXIV, pp. 575–578), discusses the standing of the Linnæan genera *Myrmecophaga* and *Didelphis*. While I agree with his conclusions in respect to the former, I cannot share his view with regard to the latter. In the case of *Didelphis*, he claims with Alston (Biolog. Centr.-Amer., Vol. I, p. 196, footnote) and the present writer (Bull. Am. Mus. Nat. Hist., Vol. IX, 1897, p. 43) that *D. marsupialis* "is unrecognizable." Mr. Alston adopted the name *D. virginiana* Kerr for the North American Opossum as being "the earliest name which can be clearly and certainly identified with this species"; he adding: "Linnæus's *D. marsupialis* (Syst. Nat. [ed. 12], I, p. 71) is evidently founded on a confusion of the North American Opossum with some of the South American forms, probably *D. cancrivora* Gmelin; and the same remark applies to descriptions of his earlier followers. In such a case it seems advisable to relinquish the uncertain title altogether." In 1897 (*l. c.*,) I said: "The name *marsupialis* is here recognized only provisionally, and in the belief that it should be discarded as indeterminable, in view of the fact that several quite distinct forms have been included under it. The original Linnæan species *marsupialis* was intricately composite. . . . If we take Linnæus's diagnosis (Syst. Nat., ed. 10, 1758, p. 55) as the basis of the name, it seems to point to *D. aurita* rather than to *D. virginiana* — to an animal with a tail as long as the body and the ears black, tipped with white. It is clearly not *D. karkinophaga*."

As the above quotations show, Mr. Rehn is perhaps fairly justified in citing Alston and myself in support of his side of the question. But since, through Mr. Rehn's action in the matter, the case has become more serious, it seems desirable to go once more over the subject, for his position, if really tenable, involves a most serious overturn of names long currently accepted. As stated by Mr. Rehn, three of Linnæus's four valid species were

successively removed from the Linnæan genus *Didelphis* as types of new genera, namely *D. philander*, as the type of the genus *Philander*; *D. marmosa*, as the type of the genus *Marmosa*; and *D. opossum*, as the type of the genus *Metachirus*; leaving only *D. marsupialis*, which is claimed to be unrecognizable. As *D. opossum* was the last recognizable species removed from the genus *Didelphis*, this species, according to prevailing rules of nomenclature, he claims must be taken as the type of *Didelphis*, and *Sarigua* (Muirhead, "1819"[1]) be employed for the group of species for which *Didelphis* has been hitherto almost universally employed. It therefore seems almost as desirable to conserve Linnæus's species *marsupialis* as his genus *Didelphis*.

It may be noted, first, that there is no doubt whatever that the name *marsupialis* applies almost strictly to the large Opossums of the *virginiana* type, of both North America and South America. The trouble is to restrict the name satisfactorily to some one form of the group of species and subspecies described since Linnæus published the name *marsupialis*. It is a recognized rule of nomenclature that a name applied to a composite group, whether specific or generic, must be conserved for some one of its components when the group is later subdivided. Where a diagnosis is imperfect or indecisive, as in the case of a large proportion of the species of the older authors, including Linnæus, it is necessary, in attempting to restrict the name to some particular form included in a composite group, to examine the references on which the name was originally based, as well as the diagnosis, the former often being of far greater importance than the latter.

In this case Linnæus's first reference is to the Philander of Seba ("Mus. I, p. 64, t. 39"), which is not an American animal, but a species of *Phalanger* from Amboyna, and hence not the animal called Philander from South America.

Linnæus's second reference is to Tyson. Dr. Tyson's first memoir is entitled 'Carigueya, seu Marsupiale Americanum; or, The Anatomy of an Opossum,' published in the 'Philosophical

[1] Mr. Rehn says: "The large opossums formerly called Didelphis require a name, and the oldest one available is Sarigua Muirhead, with *S. virginiana* as the type. The complete reference is *Sarigua* Muirhead, Brewster's *Amer. Edition Edinburgh Encyclopædia*, Vol. XII, Part II, p. 505, 1819."

This reference, however, is erroneous as to date, and misleading as to the title of the work cited. The correct citation would be Brewster's Edinburgh Encyclopædia, Amer. Ed., Vol. XII., Pt. 2, p. 505, 1832. The important error is in the date, which is 1832 instead of 1819. The reference to the original edition, where the matter is the same, is Brewster's Edinburgh Encyclopædia, Vol. XIII, p. 429, 1830—the date being in this case 1830 instead of 1832.

Transactions' in 1698 (Vol. XX, No. 239, pp. 105–164, with 2 pll.), and based on an animal "brought alive from Virginia," of which he gave not only a scientific and detailed account of its anatomy but also of its external characters. Linnæus's reference is to Tyson's second memoir on the same animal, published six years later (Philos. Trans., Vol. XXIV, 1704, pp. 1565–1575), which is followed by a memoir by Dr. Cowper, on 'The Anatomy of those Parts of a Male Opossum that differ from the Female' (*ibid.*, pp. 1576–1590, with 1 pl.). "This male Opossum," says Dr. Cowper, "as well as the female dissected by Dr. Tyson, was brought from Virginia, and presented to the Royal Society." Then follow references to DeLaet, Marcgrave, Piso, and Hernandez, which mainly relate to the large South American Opossums, but not very distinctly to any particular form of this varied group. In the reference to Tyson we have distinctly a reference to the Virginia Opossum, and to that member of the Opossum group only. It therefore seems consonant with the rules of nomenclature for such cases, as well as with current usage, to fix the name *Didelphis marsupialis* upon the Virginia Opossum, which thus becomes, by elimination, the type of the Linnæan genus *Didelphis*. Then we have, in chronological sequence, *Didelphis karkinophaga* Zimmermann (1780), based exclusively on 'Le Crabier' of Buffon (Suppl., Vol. III, p. 272, pl. liv) from Cayenne, for the form from northeastern South America; *D. azaræ* Temminck (1826[1]) for the animal of Paraguay and Bolivia, and *Didelphis aurita* Wied (1826) for the form from southeastern Brazil. Later followed *Didelphis californica* and *D. breviceps* (1833), based on specimens from Mexico.

The name *Sarigua*, in the French vernacular form *Sarigues*, was used by G. Cuvier (Tabl. élém. de l' Hist. Nat. Anim., an 6 [=1798], p. 124) as early as 1798 for the American Marsupials collectively, as the name of the first of his three divisions of *Didelphis* Linn., the others being, respectively, *Dasyures* and *Phalangers*, for the Australian Marsupials. Desmarest used the term *Sarigue* as a vernacular equivalent of *Didelphis* Linn. in

[1] As there seems to be no doubt that the second volume of Wied's 'Beiträge zur Naturgeschichte von Brasilien' was published in 1826, it seems certain that that part of Temminck's 'Monographies de Mammalogie' treating of the Opossums should bear at least as early a date, as Wied cites this part of Temminck's work, giving page references. Thus *aurita* has evidently *not* "a year's clear priority over *azaræ*," as stated by Alston (Biol. Cent.-Am., p. 197), but is of somewhat later date.

1804 (Nouv. Dict. d'Hist. Nat., Vol. XXIV, 1804, Mamm., p. 19), whence Muirhead evidently obtained it, as he ascribes the name to Desmarest.[1] The name Sarigue was used in a vernacular sense by Buffon (Hist. Nat., Vol. X, p. 279 *et seq.*) in 1763, evidently as a modification of *Carigueya* of Tyson, who derived it from still earlier writers.

The genus *Philander* is usually ascribed to Tiedemann (1808), but as used by this author it is a pure synonym of *Didelphis* Linnæus, being merely a renaming of the genus, as long since pointed out by Mr. Thomas (Cat. Marsup. and Monotr. Br. Mus., 1888, p. 336, footnote). The name *Philander*, however, was first employed in a generic sense by Brisson in 1756, who included under it all of the Marsupials known to him, and again in 1762 for the same species. The first use of the name *Philander* by Brisson being previous to 1758, the name is not tenable from its first date, but would be from 1762, had not Linnæus in the meantime established the genus *Didelphis*, for practically the same species.[2] The exception is a species of *Phalanger* from the East Indies. According to current usage in similar cases,[3] *Philander* should be thrown out as untenable for any generic group, unless, by the process of elimination, it can be fixed upon the group to which Storr in 1780 gave the name *Phalanger*. This would, of course, do away with any availability it might otherwise have in American mammalogy.

Dr. J. E. Gray in 1843 (List Mamm. Br. Mus., 1843, pp. xxi, 100) again made use of the name "*Philander* Brisson" for such a heterogeneous assemblage as *D. nudicauda* Desm., *D. karkino-*

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[1] The manner in which Dr. Muirhead used the name *Sarigua* is shown by the following transcript from his article on the "Suborder Pedimana."

"1. Genus SARIGUA, Desmar. DIDELPHIS, Lin. . . . [Here follows a short diagnosis of the genus.]

"1. *S. marsupialis*, *Didelphis marsupialis*, *cancrivora*, Lin. *Amboyna*, or *Molucca opossum*. Eight teats within the pouch. 2. *S. virginiana*, *Didelphis virginiana*, Pennant and Geoff. *Long-haired opossum*. Body covered with long brown hair; head white with a brown spot. 3. *S. opossum*, *Didelphis opossum*, Lin. *Common* or *Virginian opossum*. Half of the tail hairy; a light colored spot above the eyes. 4. *S. murina*, *Didelphis murina*, Lin. *Murine opossum*, or *marmose*. Tail hairy at the base. 5. *S. cayopollin*, *Didelphis cayopollin*, and *dorsigera*, Lin. *Mexican* or *Merian opossum*. Tail longer than the body, margin of the orbits black. 6. *S. brachyura*, *Didelphis brachyura*, Lin. *Short-tailed opossum*. Tail short; ears naked; body rufous. 7. *S. memmina*, *Didelphis memmina*, Cuv. *Yapock* or *Little otter of Guiana*. Tail hairy above, naked beneath, and nearly as long as the body. 8. *S. crassicaudata*. *Thick-tailed opossum*. Tail large and strong; upper parts of the body of a bright cinnamon hue, the under parts of a bright gray. 9. *S. pusilla*, *Didelphis pusilla*. Desmar. *Dwarf opossum*. Body of a leaden hue, and whitish underneath.

"*S. opossum*. (Pl. ccclv, Fig. 20.) This species is about the size of a small cat . . ." Then follows, under this name, about one column on the North American Opossum.

[2] *Cf.* Merriam, Science, N. S., II, No. 39, p. 418, Sept. 27, 1895.

[3] See the treatment of such nearly parallel cases as *Myodes* Pallas and *Cuniculus* Wagler by Mr. G. S. Miller, Jr. (N. Am. Fauna, No. 12, 1896, pp. 15 and 16).

phaga Zimmermann, *D. murina* Linn., etc., leaving *D. virginiana* and *D. azaræ* in *Didelphis*. No type was designated, but the first species was *D. nudicauda* Desm., which later became the type of *Metachirus* Burmeister. Still later the name *Philander* was used by Burmeister (1856) in a generic sense with *D. philander* Linn. as the type.

As already shown, however, both *Sarigua* and *Philander* are properly synonyms of *Didelphis*, and as a new name should be provided for the genus of late recognized under the name *Philander*, I suggest **Caluromys**, with *Didelphis philander* Linn. as type.

Caluromys will include not only the species now usually referred to *Philander*, but also *Didelphis cinerea* Temminck, now commonly placed in *Marmosa*; as *D. cinerea* agrees with the former not only in external characters, as notably in the heavily furred basal portion of the tail, but also in the principal characters of the skull, as in the presence of well-developed postorbital processes and in the absence of large vacuities in the posterior palate, in comparison with the species of the *Marmosa* group. The forms of *Caluromys* will thus stand as follows:

1. *Caluromys philander* (Linn.). Guiana, Venezuela, and northeastern Brazil.
2. *Caluromys cicur* (Bangs). Northeastern Colombia.
3. *Caluromys affinis* (Wagner, ex Natterer MS.). Matto Grosso, Brazil.
4. *Caluromys trinitatis* (Thomas). Trinidad.
5. *Caluromys derbianus* (Waterhouse). Ecuador (?); Central America.
6. *Caluromys derbianus ornatus* (Tschudi). Peru.
7. *Caluromys laniger* (Desm.). Paraguay.
8. *Caluromys laniger guayanus* (Thomas). Western Ecuador.
9. *Caluromys laniger pallidus* (Thomas). Northwestern Panama.
10. *Caluromys cinereus* (Desm.). Southeastern Brazil.

11. Caluromys alstoni, sp. nov.

Didelphys cinerea, ALSTON, Biol. Centr.-Am. Mamm. 199, pl. xxi (Oct. 1880). Not of Temminck.

Type, No. $\frac{11790}{16210}$, ♂ ad., Tres Rios, Costa Rica, Aug. 17, 1893; coll. George K. Cherrie. Cotypes, 1 ♀ ad. and 4 young, one fourth to one half grown.

Larger than *C. cinereus*, with the tips of the hairs of the dorsal surface dark chestnut brown instead of rufous brown, and the lower parts more strongly yellowish. Head and body in male, 180 mm.; tail, 250; hind foot (without claws), 25.

Known only from Costa Rica.

It may be of interest to state in this connection that what may be fairly considered as the type of *Didelphis cinerea* Temminck — the mounted specimen sent to Temminck by Wied (*cf.* Wied, Beiträge zur Naturg. von Bras., II, 1826, p. 409, footnote) for description — is now in this Museum, it having been received as a part of the Maximilian Collection, purchased in 1870. It is in poor condition, having suffered from long exposure as a mounted specimen, but it still has attached to it Wied's original label, which bears the legend: "No. 33, Mas. Jupatí."[1]

It is without doubt the type of Wied's description of the species (*l. c.*, pp. 406–411), and certainly a cotype of Temminck's original description (Monog. de Mamm., 1825, p. 46); he must, however, have described the female from another specimen, from Bahia, loaned him, as he states, by the Vienna Museum.

[1] Says Wied, "Dieses Beutelthier lebt im östlichen Brasilien. Ich erhielt es in den Wäldern des *Mucuri* zu *Morro d' Azara*, wo man es unter der Benennung *Jupati* mit den übrigen verwandten Arten verwechselt" (*l. c.*, p. 410).

Article XVI.—DESCRIPTIONS OF NEW AMERICAN MARSUPIALS.

By J. A. Allen.

During the last two years the Museum has received a considerable number of specimens of South American and Central American Marsupials, and in endeavoring to critically determine this material, as well as that previously in the Museum, the following species and subspecies appear to have been hitherto undescribed.

Didelphis pernigra, sp. nov.

Type, No. 16071, ♀ ad., Juliaca, Peru, altitude 7000 feet, Feb. 12, 1900; coll. H. H. Keays.

Entire upper parts, except the head, intense glistening black, the long thick black overhair entirely unmixed with the long, stiff white hairs seen in the *D. marsupialis* group; basal half or more of the soft woolly underfur pale yellowish white, the tips black, the whitish underfur concealed by the thick, heavy coat of black overhair; head white, with three prominent, sharply defined black bands, two of which are lateral, enclosing the eyes and extending from the base of the whiskers to a little behind the eyes, and continued as an ill-defined dusky patch nearly to the ears; the median black band begins as a narrow stripe opposite the anterior margin of the eyes and rapidly widens posteriorly to the nape where it merges with the black of the body; cheeks and throat rusty buff; rest of the lower parts, except the area enclosing the abdominal pouch, buffy white, with the tips of the hairs black, imparting a strong tinge of this color to the ventral surface; pouch clothed within and around its outer border with short crisp woolly hairs of a reddish chestnut tint; ears of medium size, *entirely white*, in striking contrast with the deep black of the upper surface of the body; feet black, the toes dusky brown and nearly naked; tail black for the basal two to three fifths, the rest white.

A young male about one fourth to one third grown differs in no respect in coloration from the adults. None of the specimens show any trace of the long white bristly overhairs so characteristic of the other forms of *Didelphis*.

Measurements.—Type (female), total length, 750 mm.; head and body, 383; tail, 367; hind foot, 65; ear (in dry skin), 26 x 25. A second specimen, also an adult female, measures as follows: Total length, 710; head and body, 343; tail, 367; hind foot, 61.

Skull (of type), total length, 87.5; basal length, 82; nasals, 42; palate, 52; zygomatic breadth, 42.5; mastoid breadth, 28; interorbital breadth in front of postorbital processes, 28.5, behind postorbital processes, 11. The skull of a specimen of *D. karkinophaga* from Trinidad of corresponding age is much

larger, measuring, total length, 99; basal length, 94; nasals, 48; zygomatic breadth, 50. Other female *karkinophaga* skulls from Trinidad are still larger, but otherwise than in size there seems to be no very noticeable difference, except that in *D. pernigra* the bones are very smooth, dense, and heavy in comparison with other *Didelphis* skulls.

Didelphis pernigra is based on two adult females and one young male. In style of markings and coloration they are all remarkably uniform, and appear to be eminently distinct from any other known forms of *Didelphis.*

Didelphis karkinophaga caucæ, subsp. nov.

Type, No. 14192, ♀ ad., Cali, Upper Cauca Valley, Colombia; coll. J. H. Batty.

Similar to *D. karkinophaga* from Trinidad, but darker colored throughout. Underfur whitish or yellowish white, more or less hidden by long black-tipped hairs, intermixed with long, wholly white bristly hairs, the abundance of the latter variable in different specimens; ventral surface buffy white, often inclining to rusty, the hairs tipped with blackish, so as often to give a grizzled blackish effect, wholly lacking in *karkinophaga;* head with a narrow blackish eyering, and no other distinct blackish markings, but with a general grizzled blackish effect over the whole head, the longer hairs being tipped with black, instead of almost wholly whitish as in *karkinophaga;* ears very large and wholly deep black; tail particolored, black at base and white for about the apical half.

Measurements.—Total length (of type), 740 mm.; head and body, 370; tail, 370; hind foot, 58; ear (in dry skin), 32 x 32. A male (young adult), measures, total length, 770; head and body, 410; tail, 360; hind foot, 53. Judging by the material in hand, skulls and skins (eleven specimens), the skins mostly without measurements of the fresh specimen, the Cauca Valley form of *Didelphis* is considerably smaller than the Trinidad animal, with a relatively shorter tail.

Skull rather broader than in true *karkinophaga*, but not otherwise different. Total length (of type), 94; basal length, 87; nasals, 45; palate, 55; zygomatic breadth, 50; interorbital breadth in front of postorbital processes, 19, behind postorbital processes, 11.

I have been rather surprised to find that series of specimens of the *karkinophaga* type of *Didelphis* from, respectively, the Island of Trinidad, Santa Marta, Colombia, and the Upper Cauca Valley, Colombia, present color differences that are obvious on even superficial inspection. These series number from eight to fourteen specimens each, and are all referable at a glance to their respective series; these forms hence seem entitled to recognition in nomenclature. The Santa Marta series,

described below, is recognizable not only through differences of color, but in having the ears at least one third smaller than in either of the other forms. In each form the ears are wholly black. The Trinidad form is much the larger, as shown by the following average measurements of four adult males and three adult females. *Males:* Total length, 874 mm.; head and body, 452; tail, 446; hind foot, 60.5. *Females:* Total length, 807; head and body, 406; tail, 401; hind foot, 57. While in the average the tail measures less than the head and body, there are several exceptions where the tail considerably exceeds the head and body, as in No. 6063, ♂, where the tail measures 465 and the head and body 455; No. 6051, ♂, tail 425, head and body, 385; and No. 7732, ♀, tail 430 and the head and body 400.[1] It is therefore doubtful whether in any of the forms of *Didelphis* the tail regularly exceeds the head and body in length.

There is also considerable variation in respect to the prevalence of black or white hairs in the pelage of the dorsal surface in all the forms, in some examples the long white overhairs are so abundant as to render the prevailing color whitish; in other examples they are nearly absent, leaving the prevailing color blackish.

The color differences in these three forms are quite as strongly shown in young specimens, not more than one quarter grown, as in the adults.

Didelphis karkinophaga colombica, subsp. nov.

Type, No. 15453, ♂ ad., Bonda, Santa Marta, Colombia, April 19, 1899; coll. H. H. Smith.

Similar to *D. karkinophaga caucæ* but darker throughout, the underfur a deeper shade of buffy white, and the ears much smaller. Above the long overhair is more abundant and of a brownish black, often heavily mixed with stiff, longer white hairs, but frequently the latter are wholly wanting; head without very distinct markings but with a tendency to an indistinct median stripe and a lateral one on each side, more distinctly developed behind the eyes; whole top of the head, however, with the hairs more or less tipped with brownish black, giving a general blackish grizzled effect; ventral surface more deeply buff, overlaid with a blackish grizzle produced by black-tipped hairs; ears and feet brownish black; tail black for about the basal half, the rest yellowish white.

[1] See table of measurements given in this Bulletin, Vol. IX, 1897, p. 25.

Measurements.—Total length (of type), 824 mm.; head and body, 371; tail, 453; hind foot, 57; ear (in dry skin), 26 x 26 (as against 32 x 32 in *D. karkinophaga* and *D. k. caucæ*).

Skull, total length, 94; basal length, —[1]; nasals, 46; palate, 54; zygomatic breadth, 53; mastoid breadth, 27; interorbital breadth in front of postorbital processes, 19, behind postorbital processes, 11. Another skull, of a very old male, measures, total length, 117; basal length, 109; nasals, 55; palate, 66; zygomatic breadth, 61; mastoid breadth, 35; interorbital breadth in front of postorbital processes, 23, behind postorbital processes, 10.5.

As shown by the subjoined table, the Santa Marta form averages considerably smaller than the Trinidad form.

EXTERNAL MEASUREMENTS OF *Didelphis karkinophaga colombica.*

Mus. No.	Sex.	Total Length.	Head and Body.	Tail.	Hind Foot.
14613	♂	710	355	355	57
15456	♂	980	497	483	68
15453	♂	824	371	453	57
14615	♂	786	456	330	57
14614	♀	863	406	457	54
15452	♀	812	406	406	57
15455	♀	673	318	355	57
Average of 4 males		825	420	405	60
Average of 3 females		783	377	406	56

Metachirus fuscogriseus, sp. nov.

Type, No. $\frac{9920}{8252}$, ♂ ad., Central America; presented by Albert Smith.

Above dusky, the tips of the hairs silvery, the general effect being blackish with a grayish wash; whole top of the head and a more or less distinct median band black; sides lighter with more gray, the color of the dorsal surface sharply defined against the pale yellowish white of the ventral surface; supraocular spots pale yellowish white, with a narrow band of the same color at the base of the ears above, and a broader band of the same below the ears; cheeks, throat, and fore neck rather more strongly yellowish white than the rest of the ventral surface; outer surface of fore and hind limbs like the sides but rather paler; the inner surface of the limbs like the ventral surface; feet nearly naked, brownish both above and below; ears apparently flesh-color in life, broadly edged with dark brown; tail heavily furred for about the first (proximal) inch and a half; the rest naked, dark brown basally, gradually becoming lighter apically, the last two or three inches being light brown, perhaps flesh-color in life at the tip.

[1] Base of skull imperfect.

Measurements.—Total length, 534 mm.; head and body, 251 ; tail, 283 ; hind foot, with claws, 39, without claws, 36.

Skull, total length, 66 ; basal length, 62 ; length of nasals, 32 ; upper toothrow from canine to posterior edge of last molar, 25.5 ; palatal length, 38 ; zygomatic breadth, 32 ; mastoid breadth, 19 ; least interorbital breadth, 8.5.

This species is nearly related to *Metachirus quica* (Temminck, ex Natterer, MS.), of which it is the Central American representative. The type locality of *M. quica* may be considered as the coast region of Brazil just south of Rio de Janeiro, Temminck having apparently described the species from Natterer's specimens collected there, he also adopting Natterer's manuscript name. It rather closely agrees with Mr. Thomas's description of *Didelphis* (*Metachirus*) *opossum* (Cat. Marsup. and Monotr. Br. Mus., 1888, p. 329), to which he there refers *D. quica*, Temminck. *Metachirus opossum* (Linn.), however, judging from Seba's description, on which Linnæus's name was exclusively based, was a very different animal, especially as distinguished from *D. quica* by Temminck in his monograph of this group (Monogr. de Mamm., I, p. 41) ; the upper parts being described by Seba as "chatain obscur" and by Temminck as "roux de rouille ou canelle." In either case the type locality is most probably Surinam ; Temminck's specimens were, he states, from Surinam, and Seba's specimens were from either Surinam or eastern Brazil. In providing, for convenience, a *patrie* for *D. opossum*, Surinam may be properly taken as its type locality.

The locality of the type of *M. fuscogriseus* is unfortunately not definitely known ; the specimen was found in a bunch of bananas in unloading a fruit steamer from a Central American port, most likely Colon, after its arrival alive in New York harbor. According to Alston (Biol. Centr. Am. Mam., p. 199) this form of Opossum ranges from southern Mexico to Costa Rica.

Metachirus tschudii, sp. nov.

Didelphys myosurus TSCHUDI, Fauna Peruana, I, 1844, 145. Not of Temminck.

Type, No. $\frac{11815}{10107}$, ♀ ad., Guayabamba, Peru, altitude 5500 feet, August 30, 1894 ; coll. O. T. Baron.

Above yellowish gray-brown, darker (distinctly black) along the median line, more grayish over the shoulders, and more yellowish brown on the sides, with a decided rusty tinge on the hinder part of the sides, from the region of the

loins posteriorly; whole upper surface of the head, excepting the 'eye-spots,' deep brownish black, passing into deep black on the nape, where it joins the well-defined black dorsal line; cheeks and supraloral spots straw-color; posterior base of the ears fulvous gray, forming an ill-defined patch; outer surface of the limbs in general like the sides of the body, passing into dusky on the forearms; whole lower surface pale yellowish white, this tint a little stronger on the breast and throat; ears light brown, apparently flesh-color in life for the basal fourth; fore feet brown proximally, toes nearly bare, flesh-color; hind feet dark brown, the toes sparsely haired, light brown; tail dark brown proximally on the upper surface only, becoming gradually lighter towards the tip, the apical third being dull whitish; less than half an inch of the basal portion is clothed with short fur like that of the adjoining portion of the body. The pouch is indicated in the skin by an area about 50 mm. in length by about 25 mm. in width clothed with short, crisp, woolly hairs of a dark rusty brown color, in strong contrast with the rest of the ventral surface. The number of mammæ cannot be distinguished.

Measurements.—Total length, 500 mm.; head and body, 240; tail, 260; hind foot, 43.

Skull, total length, 55; basal length, 51; nasals, 26; palate, 30; zygomatic breadth, 26.5; mastoid breadth, 21.5; least interorbital breadth, 14.5. The skull is of the usual form for the genus and calls for no special comment.

This species is distinctly indicated by Tschudi (*l. c.*), under the name "*Didelphys myosurus* Temm." After citing Temminck's description he notes that his specimens do not wholly agree in coloration with examples from Guiana and Surinam, they being much more intensely colored, as is the case with many other Peruvian animals in comparison with their east coast representatives. The difference is often so considerable, he says, as to many times tempt one to recognize them as distinct species. *Metachirus tschudii* is undoubtedly the western representative of Temminck's *D. myosurus*, which, rightly or wrongly, is commonly synonymized with E. Geoffroy's *D. nudicaudata.*

Metachirus nudicaudatus colombianus, subsp. nov.

Type, No. 15448, ♂ ad., Donamo, Santa Marta District, Colombia, April 20, 1899; coll. H. H. Smith.

Above dark yellowish brown, strongly varied with black, which forms a fairly well defined blackish median area; sides uniform yellowish brown; head brownish black, passing into black on the top of the head and nape and around the eyes, which are broadly margined with black; supraocular spots deep buff; fur at base of the ears above rusty buff; cheeks buff, a little paler than the eye-spots; below white, tinged faintly with yellowish, more strongly

on the fore neck and throat; ears (in dry skin) pale brown; outer surface of fore and hind limbs like the sides of the body but much less fulvous and tinged with gray; fore and hind feet brown with a tinge of grayish fulvous, the toes lighter and very thinly haired; tail blackish brown above at the extreme base, gradually becoming lighter, the lower surface throughout and the apical two fifths whitish; it is clothed with thick fur like that of the body for about one inch at the base.

Measurements.—Total length, 606 mm.; head and body, 296; tail, 310; hind foot, with claws, 45, without claws, 41.

Skull, total length, 59; basal length, 53; length of nasals, 27.5; palatal length, 31; zygomatic breadth, 29; mastoid breadth, 18.2; least interorbital breadth, 9.3.

Differs from *M. nudicaudatus* (type locality Cayenne) in its darker coloration and somewhat larger size.

Marmosa chapmani, sp. nov.

Didelphis (*Micoureus*) *murina* ALLEN & CHAPMAN, Bull. Am. Mus. Nat. Hist. V, 1893, 230. Not of Linnæus and later authors.

Type, No. $\frac{7666}{6052}$, ♂ ad., Caura, Trinidad, April 7, 1894; coll. Frank M. Chapman.

Very much larger than *M. murina* and much darker colored. Above dark yellowish brown; below pale buffy white; black ocular spot large, extending from the base of the whiskers posteriorly nearly to the ear, restricted below the eye to a narrow line, expanded above the eye to a width of 3 to 4 mm., and behind the eye 7 to 9 mm.; nose patch buff, much lighter than the top of the head; ears large, pale brown; feet yellowish, much lighter than the general color above; tail dull brown above, much paler below, hence indistinctly bicolor.

Measurements.—Total length (of type), 376 mm.; head and body, 175; tail, 201; hind foot, 25; ear from notch, 32, from crown (dry skin), 18, by 17 in width. "Sixteen adult males, measured before skinning, range in size as follows: Total length, 361 (340–395) mm.; head and body, 171 (155–189); tail, 190 (175–218); hind foot, 24.4 (20–28); ear, 25 (22–29). Four females measure as follows: Total length, 324 (302–365); head and body, 148 (132–168); tail, 176 (163–197); hind foot, 22 (20–24); ear, 22 (20–23)."—Allen & Chapman, *l. c.*

Skull broad, the zygomatic arches much expanded, the supraorbital bead heavy, expanded at the middle in old skulls into a slight postorbital process. Total length (of type), 41; basal length, 37; nasals, 15; palate, 21; zygomatic breadth, 23; mastoid breadth, 15; interorbital breadth, 8.5.

Since Mr. Chapman and I referred the Trinidad species of *Marmosa* to *M. murina*, the Museum has received examples of true *M. murina* from Brazil and Venezuela. These show that

the Trinidad form—here named *M. chapmani*, in honor of my colleague Mr. Frank M. Chapman, to whom science is so deeply indebted for his researches on the mammals and birds of Trinidad —is a very much larger animal than the true *murina*, and much more deeply colored. Average male specimens of the latter have a total length of about 305 mm., the head and body constituting about 140 and the tail 165, as against 361, 171, and 190 for *M. chapmani*.

Marmosa klagesi, sp. nov.

Type, No. 16121, ♂ ad., Ciudad Bolivar, Venezuela, Oct. 26, 1899; coll. Samuel M. Klages, after whom the species is named.

Above dull grayish brown with a dark rufescent tinge, the general effect approaching dull russet brown; space between the eyes but little lighter than the crown; dark loral spot enclosing the eye deep black, extending from the base of the whiskers only to the posterior canthus of the eye, below the eye reduced to a narrow line, but above the eye widening so as to occupy nearly one third of the space between the eyes; whole ventral surface pale yellowish white, brighter on the chest, fore neck, and throat; ears brown, much darker than in *M. murina*; fore feet pale yellowish brown; tarsi dull brown, the toes much lighter.

Measurements.—Total length of type, 325 mm.; head and body, 155; tail, 170 (collector's measurements from the fresh specimen); ear (in dry skin) 16 x 14; hind foot, 18.

Skull, in size and general form, much as in *M. murina*, but the supraorbital bead is much more expanded laterally, forming an obtuse postorbital process. Total length, 36.5; basal length, 31.5; nasals, 16.5; palate, 18.3; zygomatic breadth, 20.5; mastoid breadth, 18; least interorbital breadth, 6.3; greatest interorbital breadth, 8.6.

Marmosa klagesi is based on three specimens, all males, two of which are adult and the other about one third grown. The young specimen scarcely differs in any respect in coloration from the adults; the pelage, however, is softer in texture, or less firm and velvety. Even at this early age the skull shows an incipient supraorbital bead. The species seems to be very distinct from any previously described. It is smaller than *M. chapmani*, and differs from it markedly in coloration and cranial characters.

Thylamys keaysi, sp. nov.

Type, No. 16068, ♂ ad., Juliaca, Peru, altitude 6000 feet, Jan. 8, 1900; coll. H. H. Keays, for whom the species is named.

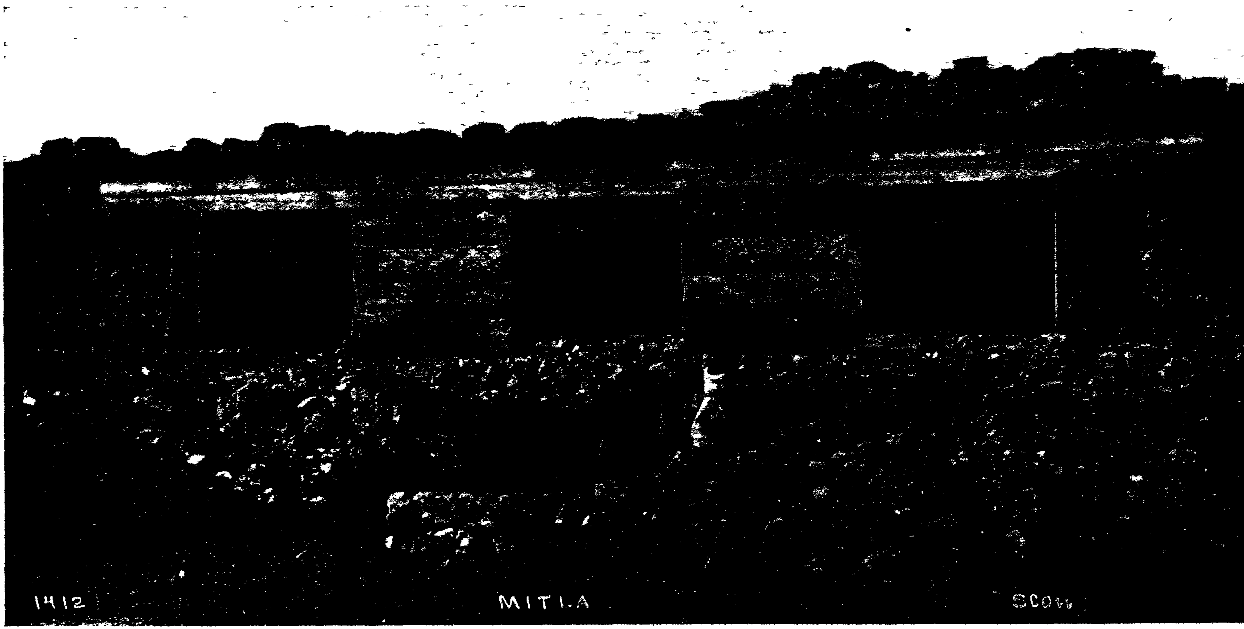
Above dark reddish brown suffused with blackish ; sides lighter and more rufescent ; ventral surface pale buffy white ; nose patch but little lighter than the top of the head ; ocular patch deep black, barely enclosing the eye posteriorly, and extending as a broad band to the nose ; cheeks pale buff ; ventral surface dull yellowish white ; ears blackish ; feet blackish brown, the toes lighter ; tail rather light brown, darkest proximally on the upper surface, the lower surface and the apical third almost flesh-color.

Measurements. — Type (collector's measurements), total length, 355 mm.; head and body, 151 ; tail, 204 ; hind foot, 22 ; ear (in dry skin), 15 x 14.

Skull long and narrow, zygoma very little expanded ; nasals narrow, very slightly expanded posteriorly ; interorbital region flat, cylindrical ; supraorbital bead very slightly developed, and present only in very old specimens. Total length, 39.5 ; basal length, 36 ; nasals, 19 ; palate, 21 ; zygomatic breadth, 20 ; mastoid breadth, 13 ; interorbital breadth, 7.7.

This species is represented by three specimens, an 'old adult' male (the type), a 'young adult' male, and a 'young adult' female. The two males present practically the same measurements ; the female is much smaller than the males, measuring as follows : Total length, 317 ; head and body, 132 ; tail, 185 ; hind foot, 17. The female has no pouch ; three nipples are clearly visible on the left side of the inguinal region ; on the right side the skin is not in good condition.

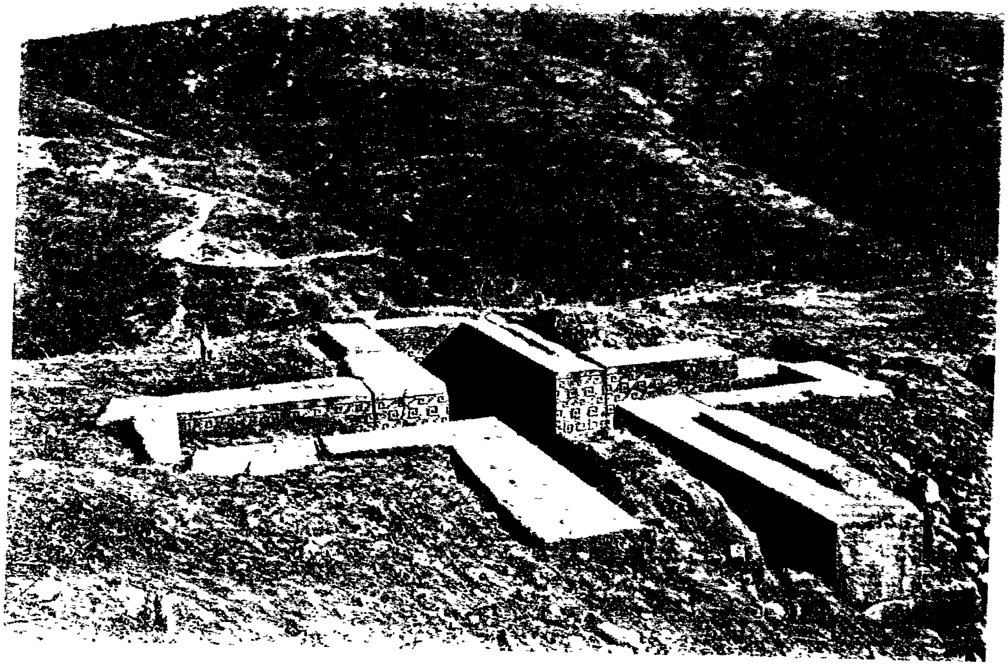
Thylamys keaysi is easily recognized by its dusky brown color and very long tail, which is fully one fourth longer than the head and body. Its long, narrow skull, the nearly smooth edges of the interorbital region, and the very slight posterior widening of the nasals seem to ally it more nearly with the *Thylamys* group than with the typical forms of *Marmosa*. In coloration it also resembles *T. carri* from Trinidad, but the tone is darker, and it is also a much larger animal.



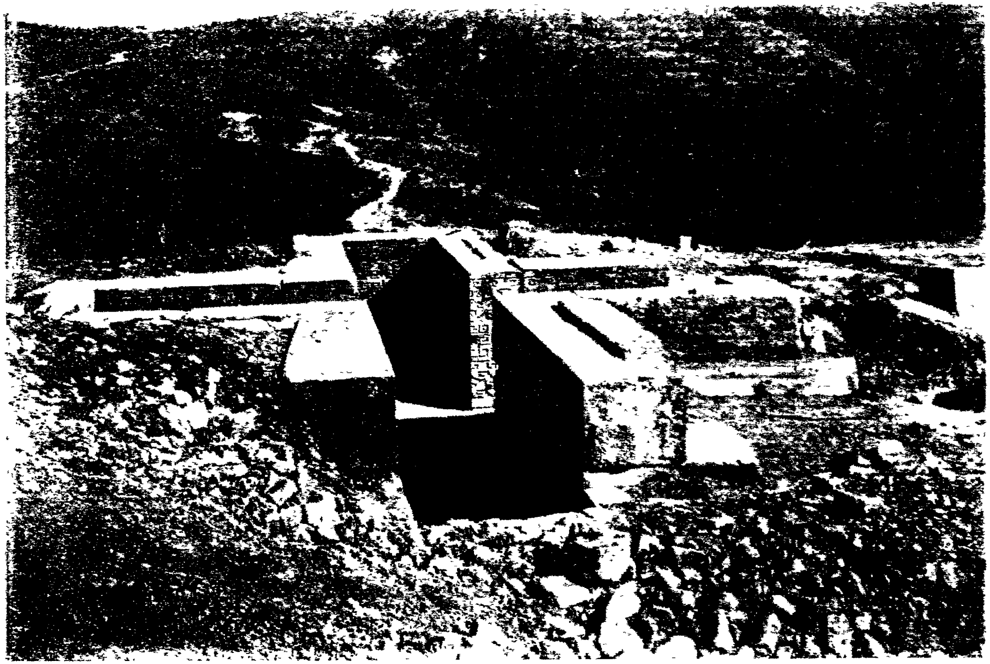
FRONT OF BUILDING, QUADRANGLE OF THE SUBTERRANEAN GALLERIES. SHOWING PRESENT ENTRANCE TO CRUCIFORM CHAMBER.

General View of Valley of Mitla. Looking East. Guiaroo Mountain in the Background, "Palaces" in the Foreground.

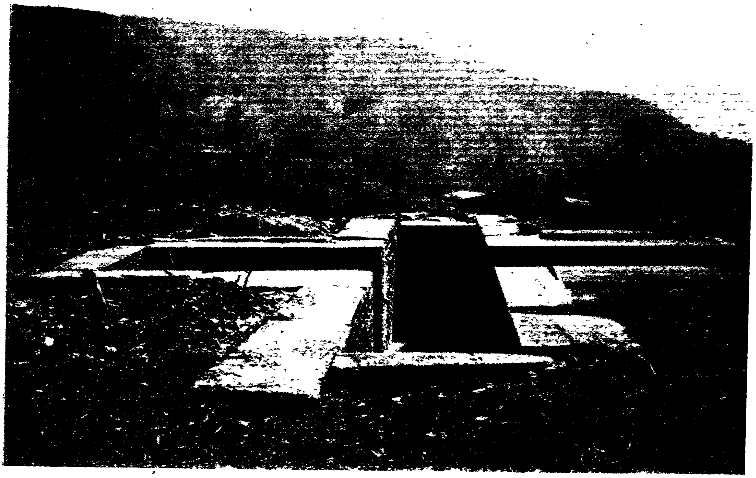
ENTRANCE OF CRUCIFORM CHAMBER. LOOKING EAST. LOWER GUIAROO.



CRUCIFORM CHAMBER. LOOKING SOUTHEAST, BEFORE EXCAVATION. UPPER GUIAROO.

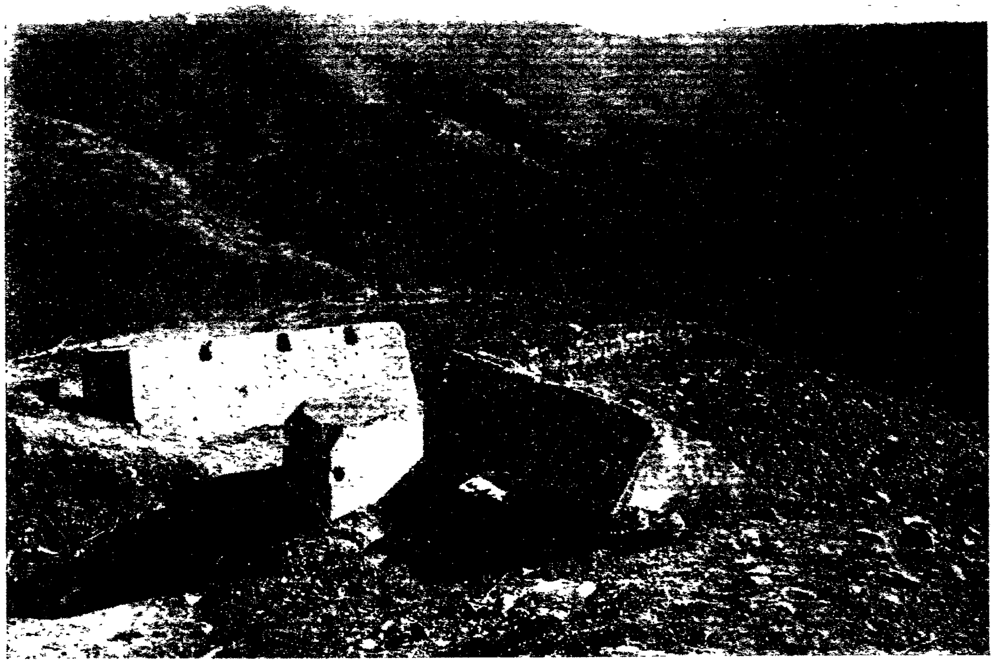


Cruciform Chamber. Looking East, After Excavation. Upper Guiaroo.

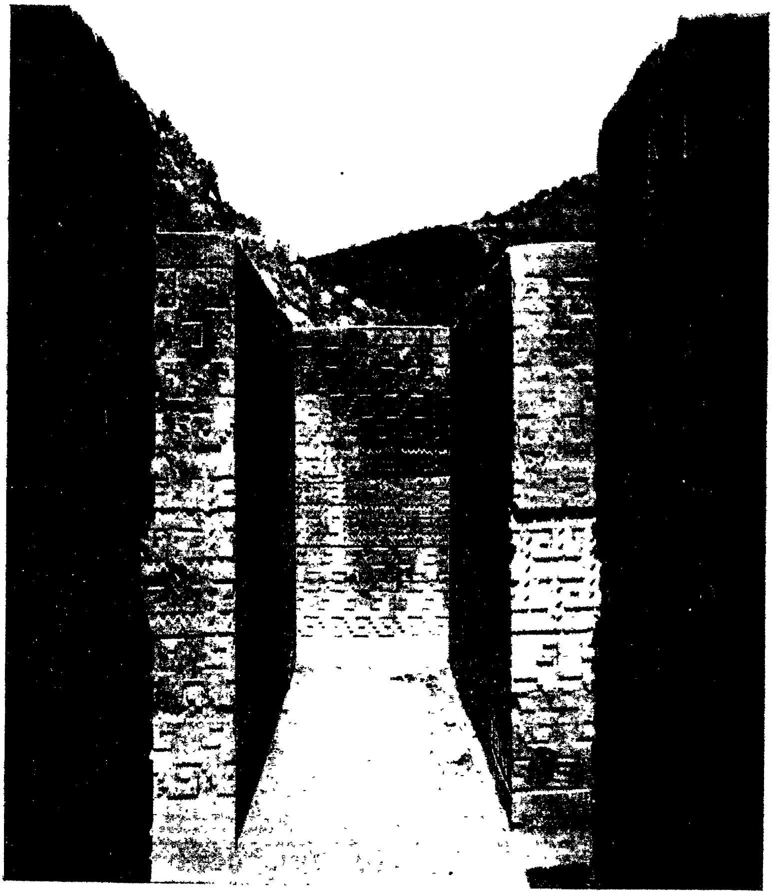


CRUCIFORM CHAMBER. LOOKING SOUTH, SHOWING PLAIN WALL AT END OF SOUTHERN ARM. UPPER GUIAROO.

EXCAVATION MADE OUTSIDE OF CRUCIFORM CHAMBER. LOOKING NORTHEAST.
UPPER GUIAROO.

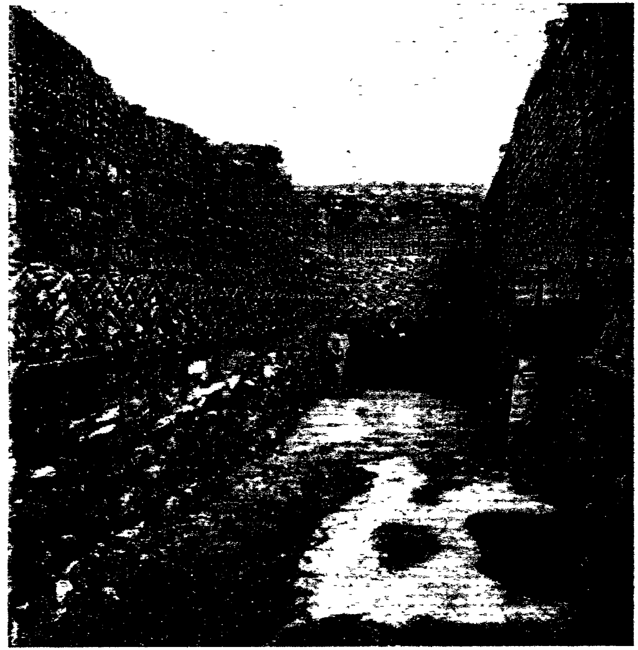


Large Blocks of Stone Lying South of Cruciform Chamber. Upper Guiaroo.



CRUCIFORM CHAMBER, LOOKING NORTH, INSIDE OF STRUCTURE. UPPER GUIAROO.

PORTION OF FACADE OF "HOUSE OF THE GOVERNOR," UXMAL, YUCATAN.



"HALL OF THE MOSAICS," MITLA.

Article XVII.—CRUCIFORM STRUCTURES NEAR MITLA.

By Marshall H. Saville.

Plates VIII-XVII.

During the winters of 1898 and 1900, the American Museum of Natural History made extensive explorations in the State of Oaxaca, Mexico, under the terms of a concession granted by the Mexican Government, represented in the field by Sr. D. Leopoldo Batres, Inspector of Ancient Monuments.

In 1898 the expedition made excavations in the mogotes (mounds) at Xoxo, about two leagues south of the city of Oaxaca. A brief résumé of these explorations has been published in the 'American Anthropologist,' New Series, Vol. I, No. 2, 1899.[1] Minor excavations were made at Monte Alban, near Oaxaca, one of the most extensive of ancient ruined cities in Mexico. This entire region is filled with groups of mounds, showing a thickly populated province in former times.

In January and February, 1900, an expedition was in the field at the famous ruins of Mitla, which are situated about ten leagues east of the city of Oaxaca. Mitla was rarely visited by explorers until a few years ago. Since the completion of the Mexican Southern Railroad to the city of Oaxaca, the capital of the State, the ruins are visited by hundreds of tourists from the United States every year, with an increasing number of visitors each season. The journey is a comparatively easy one and is best made during the dry season, from December to April. Leaving the city of Puebla in the early morning, the train makes a gradual descent until a tropical region is reached at an elevation of about 1700 feet above the sea. As Puebla is nearly 8000 feet in altitude and Oaxaca 5000 feet, the tourist travels from the cold region to the tropics, and then into a delightful temperate zone in which are located Oaxaca and Mitla. The latter part of the journey is made through some of the grandest railroad scenery in the world. The road winds in and out at the

[1] Before publishing the details of these explorations the Museum is to continue work in several other groups of mounds, during the winter season of 1900–01. Excavations will be made at Cuilapa, Tectipac, and Macuilxochitl. All of these places are in the area of Zapotecan culture.

bottom of immense cañons, thence climbing steep grades, then down into fertile valleys, the train arriving at Oaxaca in the evening. From Oaxaca to Mitla the thirty-mile carriage ride is over a fairly good road, and the Hacienda of Sr. Quero at Mitla is one of the most delightful stopping places in Mexico.

We find the first mention of Mitla in the Post Columbian Nahuatl book, known as the Codex Telleriano Remensis. Under the account of what transpired during the reign of Ahuizotl, the Aztecan monarch who preceded Montezuma, it is stated that—"In the year two rabbits, which is 1494, the Mexicans conquered the pueblo of Mictlan, which is in the province of Huaxaca." [1] Fray Diego Duran places the subjugation of Mitla during the reign of Montezuma the First.[2] The majority of original sources agree in placing his reign between the years 1440 and 1469. From what follows in Duran's account it would seem that this expedition to Oaxaca took place between 1440 and 1454. The date 1494 of the Codex Tell. Rem. is, perhaps, the most trustworthy and is accepted by Gay.[3] The earliest mention of the ruins by a Spanish priest is made by Motolinia,[4] from whom we learn that Father Martin de Valencia passed through Mitla sometime about the year 1537, and a brief account is given of a temple containing a hall in which are columns; and that the edifices are more worthy of being seen than any others in New Spain. The first extended account of Mitla is given by Burgoa,[5] whose work is exceedingly rare. His description of the ruins is fairly accurate, but has given rise to the erroneous idea concerning the vast extent of the cruciform chamber found under one of the 'Palaces,' and also that the substructures of the buildings contain subterranean galleries.

The place was occupied by the Spaniards soon after the Conquest. The now famous "Palace of the Columns" was certainly used either for a dwelling or as a public edifice, and a Spanish window, built of bricks, still exists in the southern part of the front wall of the structure. Several of the doorways have been

[1] Codex Tell. Rem., Loubat Edition, 1899, p. 40, reverso.
[2] Historia de los Indios de Nueva España, written between 1579 and 1581, published in Mexico in 1867–80.
[3] Historia de Oaxaca, p. 185.
[4] Historia de los Indios de la Nueva España, written about 1540 and first published by Icazbalceta in 1859.
[5] Geografica Descripcion de la Parte Septentrional del Polo Artico de la America, Mexico, 1674.

partly walled up and remains of the brick walls may still be seen. One of the most important of the edifices, which contained mural paintings of the utmost value, has been partly demolished and a church and curate's house now occupy the site. A number of the rooms still exist, their beautiful stone work disfigured by numerous coats of whitewash, and the court, in which are the mural paintings, is used as a stable.

The modern exploration of Mitla dates from 1802, when Don Luis Martin and Col. de la Laguna visited the ruins and made sketches of the buildings. It was from their report and drawings that Humboldt obtained his information concerning Mitla. In 1806 the great French explorer Guillermo Dupaix and his artist Castañeda went to Milta on their second exploring tour and the results of this visit are published in 'Antiquités Mexicaines,' Paris, 1834.[1]

In 1830 the German traveller Mühlenpfordt made plans and drawings, the originals of which may now be seen in the Museum in the city of Oaxaca. Copies were made by Juan B. Carriedo, and published by him in the 'Ilustracion Mexicana,' Vol. II. This account was republished by Peñafiel in his work, 'Monumentos del Arte Mexicano Antiguo,' and Mühlenpfordt's drawings are given in the plates copied from the originals in Oaxaca.[2]

About 1860 Désiré Charnay, on his first voyage to Mexico, made photographs of the principal edifices, which were published in 1863.[3] These photographs, until recently, have been the basis for reproductions used in general works upon the Mexican ruins. The explorations of Charnay were followed by the visits of Bandelier, Ober, and Ayme in 1881.[4] In 1888 Prof. Ed. Seler of Berlin copied the mural paintings, which were published by him in 1895 through the liberality of the Duke of Loubat.[5] They have been much defaced during the past few years, since the advent of the tourists, and the colors are fast disappearing.

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[1] This work is also included by Kingsborough, but there is some discrepancy in the two publications, both in text and plates. Some material found in one work is not given in the other.

[2] Published in Berlin in 1890, an unwieldy work but of great importance. One volume of text, in Spanish, French, and English, and two volumes of plates.

[3] Cités et Ruines Américaines, Mitla, Palenqué, Izamal, Chichen Itza, Uxmal; recueillies et photographiees par Désiré Charnay, avec un texte par Viollet-Le-Duc, suivi du Voyage et des Documents de l'Auteur. Text and Atlas of 49 photographs.

[4] Bandelier, 'Archæological Tour in Mexico in 1881'; Ober, 'Travels in Mexico'; Ayme, 'Notes on Mitla, Oaxaca, Mexico, with Plans and Measurements of the Ruins.' 1882.

[5] Wandmalereien von Mitla Eine Mexikanische Bilderschrift in Fresko, 1895. A most valuable work, which contains a scholarly analysis of the deities depicted in the frescoes.

In 1895 Prof. W. H. Holmes spent one week at Mitla, on the Armour expedition, and his work is the most instructive study and description of the ruins which has ever been made.[1] None of these explorers, with the exception of Dupaix, have made excavations and their publications relate to the remains above ground. During the past century the condition of the buildings has deteriorated to a certain extent and no attention has been paid to them by the Mexican Government, except to appoint a guardian to prevent flagrant vandalism. It is a pleasing matter to record that last winter the Government, at last aroused to the value of these wonderful ruins, made an appropriation for their preservation, and active measures are being taken to shore up walls which are in danger of falling, and a fence has been built around the 'Palace of the Columns.' Furthermore, visitors are not to be allowed free access to the edifices, but must visit them in company with the Inspector.

Excavations for the American Museum of Natural History were made in the vicinity of the famous 'Palaces' within a radius of ten miles from east to west, and about three miles from north to south. In the valley in which the Mitla ruins are located are many mounds in which excavations were made, revealing the foundations of buildings now entirely destroyed; buildings partially destroyed, in which the rooms were cleaned out; and tombs, the walls of which were of stone with the 'mosaic' patterns seen in the 'Palaces.' Two burial places were discovered, but for their complete exploration more time was required than was at the disposal of the expedition. In the tombs and burial places more than thirty skeletons, in a more or less imperfect state of preservation, were taken out. The doorways of the burial chambers faced the west, but there was no regularity in the manner of interring the dead.

The hills to the east of Mitla were explored and the ruins investigated were designated Guiaroo, that being the name of the mountain which rises above them to the northeast. Between Mitla and Guiaroo is the Hacienda of Xaaga, and at this place is an extensive group of mounds known as Xaaga. Near Xaaga two tombs were discovered, and a small adobe building, almost entirely destroyed, was excavated. In the center of the room a

[1] Archæological Studies among the Ancient Cities of Mexico, 1897.

cache of 120 copper, tau-shaped objects was found; these may be cutting implements but are more generally regarded as money.

A cruciform structure was discovered more than twenty years ago, in the largest mound at Xaaga; first described, very briefly, by Bandelier, who gives a rough plan of this structure but no measurements.[1] As the top of the mound containing the chamber is occupied by the Hacienda building, the steps leading to which cover the entrance, it is impossible to photograph the doorway. Details will be given further on.

In the Guiaroo Group, in the foot-hills, two ruined adobe buildings and a cruciform, subterranean chamber were explored, and, for the first time, were cleared of the dense underbrush which covered them. These ruins were visited by Dupaix in 1806 and the cruciform structure described by him. They had not been visited by any explorer since that time.

CRUCIFORM STRUCTURES.—In this paper I shall take up only a single feature of the Mitla remains, namely, the great cruciform structures, four of which have come to our knowledge. One is in the Main Group of 'Palaces,' one at Xaaga, and two at Guiaroo. It is possible that others exist in the valley to the east of the 'Palaces.' Three of these chambers, which were unquestionably designed for tombs of the ancient priests, have the 'mosaic' decoration. No structures of like character are known in any other part of Mexico or Central America. They are by far the most elaborate and important burial chambers yet found in the New World, both in size and in beauty of stone work. Unfortunately none have been opened by archæologists, and we know nothing of what they formerly contained. Their form lends an added interest to these chambers, and analogies might be drawn with the crosses of the Old World; but such speculations are not germane to the purpose of this paper. The cross is not uncommon in old Mexican remains and must have had some deep meaning with the ancient peoples of this portion of our continent. The reason why these chambers were so constructed, in the form of a cross, I shall not undertake to answer, but light may be thrown on this question as archæological research progresses in the near future.

[1] *Op. cit.*, pp. 309, 310.

Mitla.— In the substructure of edifice 20, Group F,[1] is a cruciform structure, the plan and measurements of which I introduce for the sake of comparison, as well as to finally correct a widespread error regarding the length of the chamber forming the base of the cross, which extends southward under the courtyard of this group. Burgoa gives the tradition, extant among

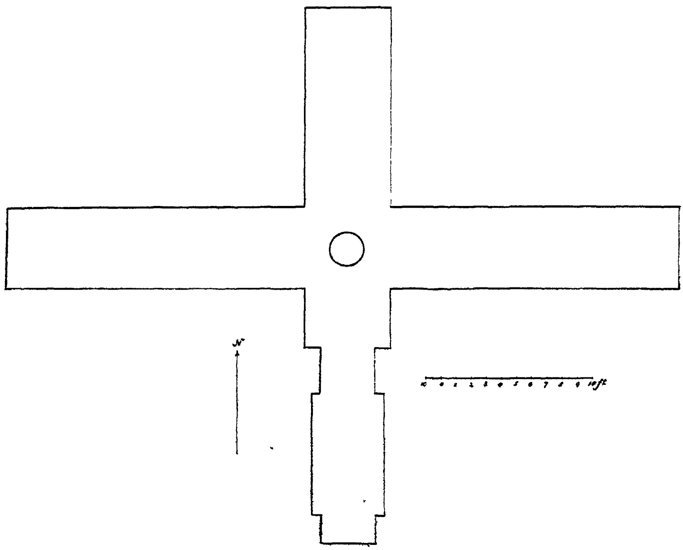

Fig. 1. Ground Plan of Cruciform Structure, Mitla.

the Indians in 1674, that the passage "ran more than thirty leagues under ground," and it was the current belief, at the time of my visit, that the chamber extended the length of the courtyard from north to south. Nevertheless, I find in Ayme's 'Notes on Mitla,' a statement that he made several excavations, and found its entire length about 9½ feet. At the time I was not aware of Ayme's investigations and therefore made an excavation in the same place, the results of which corroborated the accuracy of his statement. During the eighteen years intervening between the two excavations, the chamber had been partially filled with earth and stones which had probably washed in during the rainy sea-

[1] I follow the sketch map of Mitla published by Prof. William H. Holmes in his 'Archæological Studies Among the Ancient Cities of Mexico,' Part 2, Plate XXXIX, opposite p. 279.

son. I have recently learned that Dr. Sologüren made a trench here a few years ago.

Figure 1, after Mühlenpfordt, shows the ground plan of this cruciform structure. I shall not enter into a general description, as the main groups at Mitla and this chamber have been measured and described many times. I did not think it necessary to repeat the work of measuring, but a careful comparison of the figures given by Dupaix, Bandelier, Ayme, Holmes, and Corner,[1] shows that no two explorers agree in their measurements of this important structure. The dimensions I give, taken from Mühlenpfordt, are probably not far from correct, but can only be considered approximate.

The entrance was undoubtedly at the base of the cross and faced the south. As before stated, this part of the tomb is beneath the courtyard, and a flight of steps leads upwards to the other three rooms, which are in the substructure of the 'Palace,' above the level of the court. The walls of the several chambers are 'mosaic,'—that is, the geometric designs are made by the fitting together of small stones of different sizes. Some of these stones are more deeply imbedded than others, resulting in a geometric pattern formed by the projecting stones. This 'mosaic' or grecque work is shown in Plate I, from a photograph taken by Winfield Scott of a portion of the 'Palace,' below which is seen the present entrance to the cross. Most of the 'mosaic' panels are nearly destroyed, the designs being traced by the broken edges of the projecting stones which had formed the pattern. Some traces yet remain of a coating of white cement, painted red. It is extremely probable that the defacing of the panels of the chamber has been done by the Indians and not by tourists. The Indians have a belief that stones or fragments taken from the buildings will, sooner or later, turn to gold.

The following dimensions are approximate:

Extreme length from east to west, 45′; extreme length from north to south, 35′; length of base of cross from southern end to lower step, 9½′; length of steps, 3 ; top step to corner of arms, 4′; length of eastern and western arms, 20′;

[1] 'Mitla: An Archæological Study of the Ancient Ruins and Remains in that Pueblo,' published in the 'Journal' of the Anthropological Institute of Great Britain, New Series, Vol. II, Aug.–Nov., 1899. This is the most recent publication on Mitla. The author states that he visited Mitla in 1891.

length of northern arm, head of cross, about 13′; average height of western, northern, and eastern arms, $6\frac{1}{2}$′; average width of galleries, eastern, northern, and southern arms, $5\frac{1}{2}$′.

XAAGA.—The Hacienda of Xaaga comprises the extreme eastern end of the Valley of Mitla, and extends for miles to the eastward; the mountains, in which are the ancient quarries and the Guiaroo groups, form a part of this great estate. The Hacienda building is about three miles southeast of the village of Mitla and is built on the top of the principal mound. Near the house are the huts of the Indian laborers, some of which are placed upon ancient mounds, while scattered about in the immediate vicinity are other remains. In the great mound under the Hacienda building is the cruciform structure, the ground plan and entrance

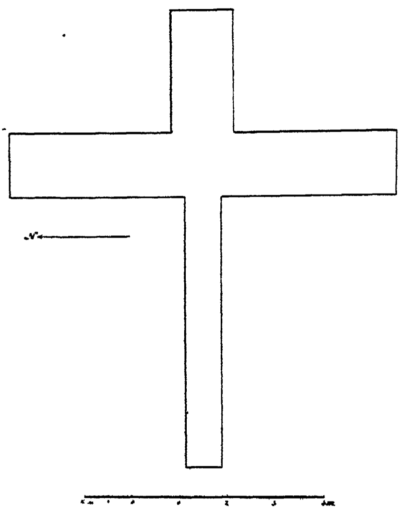
Fig. 2. Ground Plan of Cruciform Chamber, Xaaga.

of which are shown in Figures 2 and 3. The entrance at the foot of the cross faces the west and was found sealed by a large stone resting on a step 19 cm. in height, a short distance from the edge of the mound. The floor of the structure is approximately on a level with the ground in the immediate vicinity. An excavation of this mound would very likely reveal walls and possibly the ruins of a building: this was the case in mound 2, in which tomb 1 was found during the past winter: the tomb was in the western side of the mound and excavations revealed walls and a filled-in structure. The four chambers which form the cross are covered by large, flat roof-stones. Over the western chamber or base there are four stones which form the lower roof, and beyond are four others which extend to the junction of the four arms. The height of this chamber varies; at the entrance, which is low, it is 1 m. 15

cm. in height. At a distance of 1 m. 60 cm. from the door the roof rises 6 cm., the average height throughout the entire structure being 1 m. 68 cm. Over the eastern chamber or head of the cross, one stone forms the roof; over the northern arm are three and over the southern arm are four stone slabs. The center of the cross is covered by a single large stone, at which point the floor is depressed 15 cm. The floor of the entire structure is covered by cement 6 cm. in thickness.

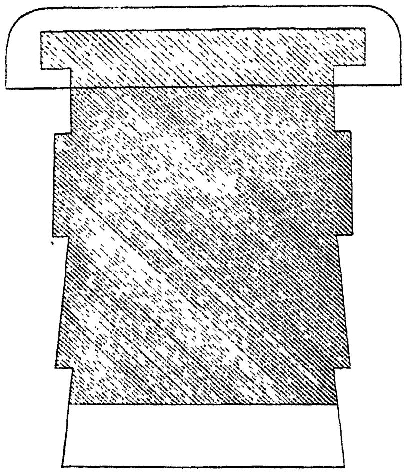

Fig. 3. Entrance to Cruciform, Chamber, Xaaga.

The stone work of the eleven walls resembles that of the outer walls of the 'Palaces,' being composed of five courses of stones. In the center of each of the walls is a 'mosaic' panel. In the different panels are found repeated all of the various designs seen in the 'Palaces' and several peculiar to this structure. These panels are colored: the inner surface is painted red, while the design in relief is covered by a thin coating of white cement. Each of these panels is composed of from three to five stones. In the eastern side of the southern arm, at the point indicated in the ground plan (Fig. 2), is an animal's head, carved out of stone, painted red, which projects about 6 cm. from the wall above the panel. This feature was found in two 'mosaic' tombs discovered at Mitla the past winter. The dimensions of the chamber are as follows[1]:

Extreme length from east to west................	9 m. 71 cm.
Extreme length from north to south..............	7 m. 98 cm.
Length of base of cross..........................	5 m. 72 cm.
Length of head of cross	2 m. 64 cm.
Length of northern and southern arms............	3 m. 43 cm.

[1] These measurements are in metres, taken during the expedition of 1898. The measurements taken at Mitla and vicinity are in feet and tenths, for the reason that my metric system tape line mysteriously disappeared.

Width of northern and southern arms	1 m. 35 cm.
Width of entrance and entire base of cross.......	80 cm.
Width of head of cross	1 m. 32 cm.

GUIAROO. — The general location of this group is shown in Plate II, being in the depression of the mountain range, directly in the center of the picture, outlined against the horizon. They are situated about four miles east of the village of Mitla and the hill upon which they are located is about one thousand feet above the valley. The high peak at the left is Guiaroo mountain; Guiaroo is a Zapotecan word, meaning high mountain.[1] The Xaaga ruins are in the valley at the base of the mountains, at the right of the picture. The quarries are in front of Guiaroo peak, on the mountain, the top of which is barely discernible in the view. In the foreground are the two main groups of 'Palaces.'

The hill is covered by a dense underbrush and there was formerly no road leading up to the ruins from the valley below. There is a fairly good ox-cart road to the base of the foot-hills, and from that point a road was made to the summit, so that now the ascent may be easily accomplished on horseback. The spur on which the ruins are located is separated from the lower hills to the west, and the high mountain ridge to the east, by deep and almost impassable barrancas.

The view looking west from the ruins is magnificent; the entire valley of Mitla is spread out before one, and the high mountains of the Mixteca, forty miles distant, are seen in the background. This spur would have formed a natural stronghold in case of attack by an enemy, as the only practicable approach would have been from the high hill to the north, on which the ancient quarries were located. It is not a desirable location for a large settlement, for the reason that the entire available space on the summit is occupied by the temple and sepulchral ruins, and it would have been impossible for the steep sides of the hill to be used for habitation sites.

GUIAROO. LOWER GROUP.—The entrance of the cruciform chamber, discovered by Dupaix, is illustrated in Plate III, and the ground plan is given in Figure 4. Dupaix's plan is not cor-

[1] The common term used by the natives in designating the ruins is 'paderones,' a corruption of the Spanish word *paredones*, walls. The Zapotecan term is *basul lyobaa*. Lyobaa is the Zapotecan name of Mitla.

rect: his plan shows steps which have never existed, and the cross section which he gives of the tomb, with 'mosaic' panels, is absolutely wrong! The walls of this structure are composed of medium sized stones, covered with cement; in the center, where the four arms join, the four corners are made of large stones. The walls are painted, the lower half being red, the upper part white, the natural color of the cement. The dimensions of the structure do not show the regularity seen in the Xaaga tomb.[1]

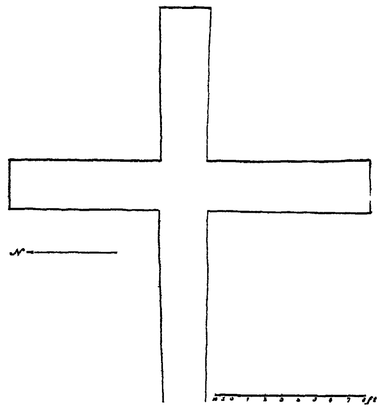

Fig. 4. Cruciform Chamber, Guiaroo, lower group.

The dimensions (given in feet and tenths) are as follows:

Extreme length from east to west	24. feet
Extreme length from north to south	29.9 feet
Length of base of cross	12. feet
Length of head of cross	9.3 feet
Length of northern arm	9.2 feet
Length of southern arm	9.9 feet
Width of entrance	2.6 feet
Width of head of cross	3.1 feet
Width of end of northern arm	3. feet
Width of end of southern arm	3 2 feet
Average height of the chamber	4.4 feet

At the present entrance, which is at the base of the cross, and faces the west, there are no signs of any stone which might have served to seal the chamber. It is but a slight distance below the level, between the two adobe houses, and the eastern part of the vault is under the eastern adobe house, a portion of the wall being seen in the upper right-hand corner of Plate III. The rude stone

[1] Dupaix gives the following description of this tomb: "Under the principal entrance of this building, at a very little depth, is a subterranean sepulchre: it is constructed in a simple style, and its plan is in form of a cross, constituting four chambers, the walls of which are coated with square stones polished and painted with ochre. A flight of stairs leads to it, and their descent faces the west. We found nothing in this dismal vault but the remains of a deer and a kid, which some leopard or wolf, the present occupants of this ancient house, had dragged to this solitary spot."

work of this structure is somewhat similar to that of two small tombs found in the valley, and may indicate the work of the later Zapotecan occupants of Mitla. They resemble also the stone work of the Xoxo tombs where the 'mosaic' treatment of decoration is entirely absent. In the valley tombs, however, no funeral urns like the Xoxo urns were found.

GUIAROO, UPPER GROUP.—The great cruciform subterranean chamber now to be described, which is destined to be one of the great attractions of Mitla in the future, is on the upper part of the hill about one hundred feet above and six hundred feet north of the main group, a little more than four miles east of the Hacienda of Mitla. To the northwest and higher up in the range of hills, about one mile distant, are the old quarries from whence were transported, in the ancient times, the immense blocks of stone which form the door lintels of the more important 'Palaces' of Milta. Many immense quarried stones still lie scattered about at the quarries, while others have been partially broken out from the bed rock. The large blocks used in the construction of the cruciform chamber were transported from this place, and on the road between these two points are several large blocks which were evidently being moved to the chamber when the work ceased. The method of transportation was probably by means of rollers and large ropes. The stones were dressed at the quarries and the 'mosaic' designs carved after they were placed in the structure.[1]

In an article on 'Oaxaca and its Surroundings,' by Dr. N. H. Wheeler, published in the 'Popular Science News' for January, 1896, this cruciform structure is mentioned; and in a small brochure issued later by the Mexican National Railroad, under the title 'Tropical Tours to Toltec Towns,' the writer quotes from a newspaper article signed 'W.' (probably Wheeler) in which a brief description with measurements is given of this tomb. The cham-

[1] This great chamber was first visited by Ober in 1881, who gives the following brief notice of its existence:

"That the hills about are full of ruins which no one has seen of late, we were fully convinced. We visited several sepulchral structures of stone, their inner surfaces carved into the same strange shapes as adorned the walls. Prof. Bandelier, sent out by the Archæological Institute of America, had remained here twelve days, but had not seen these paredones or Indian walls, in the hills which we visited. . . . We ascended the high hills in quest of the paredones above the valley,—a most tedious climb, over ridges and through barrancas. We found the largest paredon in a dense thicket on a hill commanding the whole valley near the gap through which passes the trail to the Mixe village of Ayutla. A sepulchre is formed here of massive blocks in the form of a cross, about ten feet deep, six wide, and thirty long. All the inner faces of these immense blocks are sculptured, like those of Saga, while other dressed rocks are scattered about."—*Op. cit.*, pp. 541, 542.

ber was covered by forest and half filled with debris, composed of rubble stone and earth. The view in Plate IV was taken before clearing out the debris and gives a good general idea of the cruciform plan of this structure. In the background to the left the zig-zag bridle path is seen, which leads into the region occupied

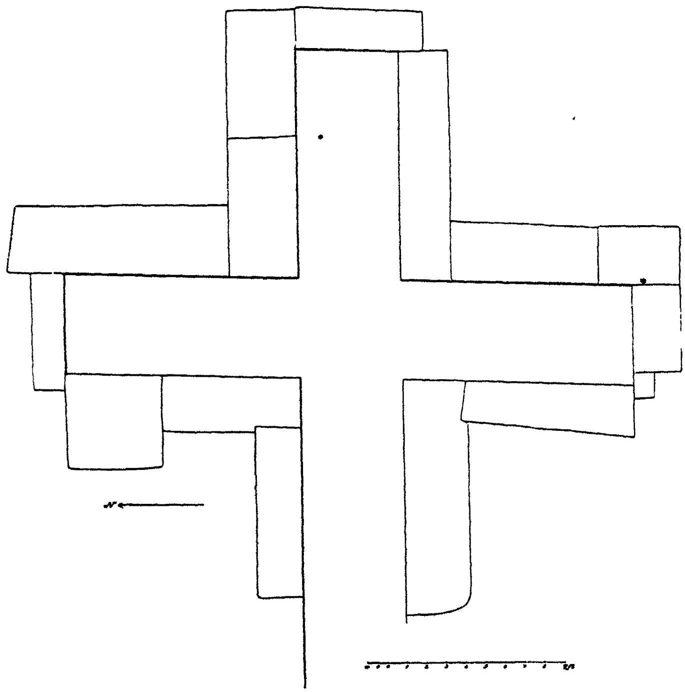

Fig. 5. Ground Plan, Cruciform Chamber, Guiaroo, upper group.

by the Mixe Indians, and is also a highway, but not the main one to Tehuantepec.

Figure 5 is the ground plan of the chamber, and shows that the angles formed by the junction of the side and end walls of the arms of the cross are not perfect right angles.

Apparently this structure was never completed. The debris with which it was partially filled did not contain the slightest trace of remains of human workmanship, and had probably fallen down and washed in from a ruined structure occupying a pyramidal-

shaped mound about twenty feet in height; the base of this mound adjoined the northwest corner of the structure, indications of which are seen in Plate VIII, at the upper left-hand corner. The large stones were pinched in place by means of the holes in the back of them (see Plate VII), and the perfect joining of these immense blocks reveals the absolute mastery of the stone worker's art. The carving was done after the walls of the chamber were completed, and the designs must have been traced out on the wall surface before the cutting of the 'mosaic' patterns. Stone chisels might have been used and probably this tool was the one employed by the ancient workmen.

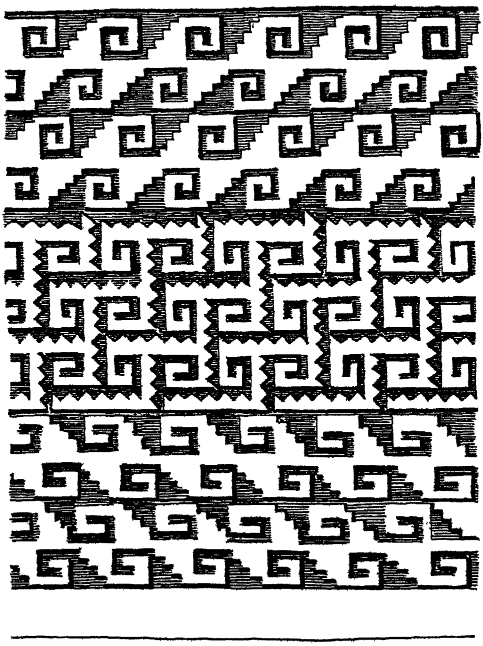

Fig. 6. 'Mosaic' Patterns, Wall of Cruciform Chamber, Guiaroo, upper group.

There are three different designs in the decoration. A drawing of the end of the northern arm is shown in Figure 6; whether the grecques are purely decorative or are conventional symbolism it is impossible to say. By a stretch of the imagination the upper and lower patterns might be resolved into a series of Swastikas. These three designs form continuous bands of decoration around the chamber; a single break in the carving is found in the plain end wall of the southern arm, a curious feature of which is the hole for pinching (see Plate VI). The depth of the carving is about three-fourths of an inch, and as a rule the serrated edges of the patterns are slightly beveled. In one place which was

well protected from weathering by the debris, a small section of the design still preserves on the part in relief a very thin coating of cement painted red. The floor of the chamber is not cemented, another proof of its unfinished condition.

In Plate IX are three stones which lie close to the southern end of the structure; holes for pinching are seen, and on the stone at the right is a raised ridge, similar to the one shown on the stones in place in Plate V. These blocks do not bear 'mosaic' carving, and were apparently intended to form the end of the western arm, the opening. The dimensions of the chamber are as follows:

Extreme length from east to west, 32'.8.
Extreme length from north to south, 28'.6.
Length of northern, eastern, and southern arms, 11'.7.
Width of northern, eastern, and southern arms, 5'.2.
Length of western arm to end of sculpture, 11'.
Total length of wall, 15'.9.
Width of eastern arm, 5'.2.
Height of chamber, 7½ feet.
Dimensions of largest block, southern wall of western arm, 12½' × 3'.3 × 3'.

Above and below the three 'mosaic' bands are plain surfaces, the upper one .4 high, the lower one .7. The heights of the various 'mosaic' designs are, respectively, upper, 2'.1, center, 2'.1½, and lower, 1'.9.

Rising from the northwest corner of this subterranean chamber is a pyramidal mound, the foundation of a building now entirely destroyed. On the top we found the remains of a much decayed skeleton, buried about two feet below the surface; two stone heads were also excavated near by, one of which is shown in Figure 7; it is beautifully carved and is one of the finest pieces of stone carving from Oaxaca. It is perhaps a portrait of one of the former occupants of this locality; the aquiline nose is one of the characteristic features of the modern Zapotecan Indian. The head is cut from a piece of volcanic tuff and is 5⅝ inches high and 4 inches wide. The projection at the back shown in Figure 7 has served to fasten the head in a stone wall, either in the outer or inner wall of a tomb.

In tomb 1 at Mitla two heads were found projecting from the front wall of the vault, one on either side of the door, slightly

above the line of the lintel. In tomb 4 two stone animals' heads were found in the interior of the chamber, one near the northeast corner, and the other in the southeast corner, both projecting just below the roof.

CHILA. — There is one other cruciform tomb which has come to my notice, and I herewith introduce the description which Bancroft gives, taken from Dupaix, which is as follows: "At Chila, in the extreme southern part of Puebla, is a hill known as La Tortuga, on which is built an unterraced pyramid, eighty-eight feet square at the base, fifty-five feet high, with a summit platform fifty feet square. It is built of hewn stone and covered, as it appeared from Castañeda's drawing, with cement. The exterior surface is much broken up by the trees that have taken root there. A stairway leads up the western front. Near the northeastern corner of the mound is an entrance leading down by seven stone steps to a small tomb about eleven feet below the surface of the ground, and not under the mound. At the foot of the steps is an apartment measuring five and a half feet long and high and four feet wide, with a branch or gallery four feet long and a little less than three feet wide and high, in the center of each of the three sides, thus giving the whole tomb in the ground plan the form of a cross. . . . There is certainly a general resemblance to be noted in this tomb structure to those at Mitla; the interior is lined with hewn blocks laid in lime mortar and covered with a fine white plaster, the plaster on the ceiling being eight or nine inches thick. The discovery of human bones in the

Fig. 7. Stone Head, found near Cruciform Chamber, Guiaroo, upper group.

lateral galleries leaves no doubt respecting the use to which the subterranean structure was devoted."[1] (See ground plan in Figure 8.)

There is another point of resemblance between the Chila cross and the chamber under the Mitla 'Palace.' Both structures have an entrance facing the south, whereas the entrances to the Xaaga and Guiaroo chambers face the west. The Zapotecan tombs at Xoxo and one of the tombs excavated at Monte Alban have doorways facing the west, which direction appears to have been the common one and probably had some symbolic meaning. In the Maya region this is not the case; no fixed point of the compass was used in the placing of the entrances to their burial chambers. As yet we have inadequate data, practically none at all, concerning the burial customs in other parts of Mexico.

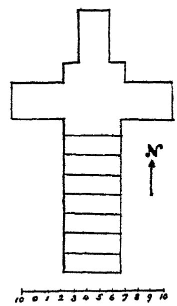

Fig. 8. Ground Plan, Cruciform Chamber, Chila.

The massiveness of the construction, and simple and chaste ornamentation, place these great Mitla tombs in a class unapproached by any other known burial chambers in ancient America. As noted by Holmes, the geometric fretwork mosaics differ from the great façades of the Yucatan buildings "in subject matter rather than in kind, for the decorated surfaces there, though depicting animal forms, are mosaics in the sense that they are made up of separate hewn or carved stones set in mortar to form ornamental designs."[2] This method of construction brings the Mitla 'Palaces' and smaller tombs into direct relationship with the Yucatan ruins. So far as I am aware, outside of Yucatan no other group of buildings with the exception of Mitla have this 'mosaic' style of stone work. In Plate X I have brought together side by side a view of a section of the front of the 'House of the Governor' in Uxmal, Yucatan, and a picture of the northern end of the 'Hall of Mosaics' in the Palace of the Columns at Milta, which will illustrate the close resemblances of the construction. There is one point of variance, however, which is quite noteworthy, namely, in the roof.

[1] Bancroft, 'Native Races of the Pacific States,' Vol. IV, Antiquities, Chap. IX, pp. 465, 466.

[2] Holmes, *op. cit.*, pp. 247, 248.

In the whole area of Maya culture the style of roof is what is known as the Mayan or triangular arch, whereas in the Mitla buildings a flat roof was used. In Yucatan flat roofs are reported from but one ruin—Tuloom, on the eastern coast of the peninsula. Stephens describes a small building visited by him in 1841 in which the ceiling is flat, and several others with fallen roofs, but with indications of the same method of roof construction.[1] On the tops of some of the walls in the Mitla edifices may still be seen the mortar sockets in which formerly rested the ends of wooden ceiling beams. In the Mayan remains outside of Yucatan, for example in Palenque, where much stucco was employed, and at the ruins of Copan, Honduras, where the great feature is sculptured monoliths, this 'mosaic' work is not found. Stucco is sparingly used in Yucatan, and there are no traces of it in Mitla. Moreover, there is very little separate stone sculpture in Yucatan, and none at Mitla. The absence of carved monoliths at Mitla is striking, when we consider the great monolithic lintels of one of the 'Palaces,' where there are single stones nearly twenty feet in length. It seems very probable that Mitla and the Yucatan ruins belong to the same epoch and are the remains of a people having kindred ancestors. I have elsewhere offered the suggestion that the building of Mitla was by the Nahuas, and that Zapotecan occupancy was the result of conquest. Modern research points to a common ancestry of both the Nahuan and Mayan peoples.

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[1] Stephens, 'Incidents of Travel in Yucatan,' Vol. II, pp. 391, 392, and pp. 398, 399. His description is interesting, and as the ruins of Tuloom have not been visited since that time, I quote what he writes concerning this roof: "The interior [of the chamber] is about seven feet high, and discloses an entirely new principle of construction. It has four principal beams of wood, about six inches in diameter, laid on the top of the wall from end to end of the chamber, with smaller beams, about three inches in diameter, laid across the larger so closely as to touch, and on these cross-beams is a thick mass of mortar and large pebbles, which was laid on moist, and now form a solid crust, being the same materials which we had seen in ruins on the floors of other rooms." This describes what was also the probable construction of the roofs of the Mitla 'Palaces.'

Article XVIII.—ON MAMMALS COLLECTED IN SOUTHEASTERN PERU, BY MR. H. H. KEAYS, WITH DESCRIPTIONS OF NEW SPECIES.

By J. A. ALLEN.

The Museum has recently received two small collections of mammals made by Mr. H. H. Keays, at Juliaca, in southeastern Peru, a little to the westward of Lake Titicaca. Mr. Keays writes: "Our camp is situated in the loop of the Inambary River. The country is very broken, with deep narrow cañons, and is covered with a dense undergrowth of shrubs and vines, with here or there a palmetto or a cedar rising above the surrounding vegetation." He gives the altitude as 6000 feet, and the position as latitude 13° 30′ S., longitude 70° W.

The collections number only 18 species, but contained several not previously described, and others of special interest. The collector's field notes are enclosed by marks of quotation, and are followed by the initials H. H. K., when not otherwise indicated.

1. **Chironectes minimus** *Zimmermann.*—One specimen, an adult male, taken Jan. 28, 1900. Mr. Keays says it "came into the mill in the flume, the flume at that time taking up all the water of the creek."

2. Didelphis pernigra *Allen.*

Didelphis pernigra ALLEN, Bull. Am. Mus. Nat. Hist. XIII, 1900, 191. Oct. 23, 1900.

Three specimens, as already described (*l. c.*). "Apparently quite common, judging by their signs along the trail. One of these animals had been robbing my traps of their bait for several days when he was caught by one front toe."—H. H. K.

3. Thylamys keaysi *Allen.*

Thylamys keaysi ALLEN, Bull. Am. Mus. Nat. Hist. XIII, 1900, 198. Oct. 23, 1900.

Three specimens, as already described (*l. c.*). "Two of the three specimens were found dead in the trail, having been killed

by some small animal of about their own size. The other was taken in a trap placed in a runway. Their stomachs all contained beetles."—H. H. K.

4. **Lagidium peruanum** *Meyen.*—One specimen, Tierapata, Peru, Oct. 9, 1899.

"This species is not to be included among the animals of this region [Juliaca]. They exist in suitable places from Lake Titicaca to the Andes. None were seen on the east side of the range, nor have I heard of any on this side. They subsist upon grass and inhabit the rough, rocky cliffs, living in the crevices of the rocks. They are very active, and are able to run up or down a perpendicular rock. They are most active in the morning and evening, though I have seen them at all hours of the day."—H. H. K.

5. **Dactylomys peruanus**, sp. nov.

Type, No. 16060, ♀ ad., Juliaca, Peru, altitude 6000 feet, March 15, 1900; Coll. H. H. Keays.

Pelage soft and full, with long bristly overhairs, but without spines. Above nearly uniform yellowish brown, varied with black-tipped hairs, without tendency to a darker median area; lighter yellowish brown on the sides; sides of nose whitish; top of nose sooty gray; top of head, to a line in front of the ears, gray varied with light yellowish brown; below white, tinged irregularly with pale buff, and with a faint brownish post-pectoral area; the color of the dorsal surface encroaches upon the sides of the abdomen, near the lower edge of which are situated the mammæ, leaving a very narrow white ventral area; base of the tail below bright ferruginous; fore arms and legs concolor with the sides of the body; fore and hind feet grayish brown, becoming lighter on the toes; ears broad, rounded above, brown, nearly naked, with a thin marginal fringe of long bushy hairs; tail considerably longer than the body, for the basal two or three inches heavily clothed with long black hairs tipped with whitish, giving a grizzled dark gray effect above and on the sides, lighter below; apically the hairs become thinner, the annulations gradually becoming visible at about the end of the basal fourth; the rest of the tail is thinly clothed with long brownish black hairs, which form a well-developed tuft at the end, the scales, except at the extreme tip, visible through the hairy covering. The greater part of the head and the basal portion of the tail are gray, in strong contrast with the dark yellowish brown color of the upper surface of the body. Mammæ 4, abdominal; at least, no others can be discovered in the present specimen.

Measurements.—Total length, 560 mm; head and body, 240; tail vertebræ, 320; hind foot, 51 (without claws, 44); ear from notch (in dry skin), 14.

Skull.—Unfortunately the basal portion is broken, so that full measurements cannot be taken. Total length, ——; basal length, ——; zygomatic width,

32; mastoid width, ——; interorbital width, 17; length of nasals, 17; width of nasals in front, 6.5; distance from nasals to fronto-parietal suture, 19.5; diastema, 12.5; palatal length, 17; upper toothrow, 16; lower toothrow, 16.5; lower jaw from tip of incisors to posterior border of condylar portion, 41.3; height at condyle, 15.

Dactylomys peruanus is based on a single female, with the teeth well worn, showing it to be fully adult. In respect to its capture the collector states (MS. notes): "I was looking after my traps just after daylight when I noticed this specimen running along the water's edge of the creek. I had no trouble killing it with a stick. Its stomach was filled with the inside of a palmetto nut, or some white tender root."

The only previously recognized species of the genus *Dactylomys* is *D. dactylinus* (Desmarest, 1817, ex E. Geoffroy MS.), based on a specimen in the Paris Museum, received from the Museum at Lisbon, and supposed to have been brought from Brazil.[1] A second specimen, a male, was collected by Natterer, on the Rio Negro; two specimens, a male and a female, were obtained on Castelnau's Voyage near Sarayacu, on the pampas of northeastern Peru (*cf.* Deville, Rev. et Mag. de Zool., 1852, 357); Dr. Günther records (P. Z. S., 1876, 743) the reception at the British Museum of "two fine skins of this rare Rodent, unfortunately without skulls, from the Rio Napo," concerning which he gives no further particulars; and Dr. Jentink mentions (Notes from the Leyden Museum, IX, 1887, 224) the acquisition by the Leyden Museum of an adult male, skin and skull, from the neighborhood of Nauta, opposite the mouth of the Ucayali River, "in northeastern Peru or Ecuador." Dr. Jentink gives external measurements and measurements of the skull of his specimen, but says nothing about its coloration. Neither can I find that the Natterer specimen has been described, beyond a transcript of Natterer's field notes by Dr. Pelzeln (Brasilische Säugethiere, 1883, 65), giving a few measurements and the color of the naked parts in life.

The original type specimen of the species has been repeatedly described, by various authors, and its skull and dentition figured (*cf.* Desmarest, I. Geoffroy, Waterhouse, etc.). Judging from these descriptions *D. peruanus* is very much smaller than *D.*

[1] "*Patrie:* l'Amérique méridionale; probablement Brazil."—I. Geoffroy, Mag. de Zool., 1840, Mamm., p. 48.

dactylinus, and very different in coloration. I. Geoffroy gives (Mag. de Zool., 1840, Mamm., 29) the length of the head and body of the Paris specimen as 350 mm. and the tail as 420 ; Dr. Pelzeln states that Natterer's specimen measured, total length 2′ 3″, length of tail, 15¼″ ; Dr. Jentink's measurements of the Leyden specimen are, head and body, 328 mm., tail, 406 mm. The corresponding measurements of the type of *D. peruanus* are, 240 mm. and 320 mm. This example is an old female, while the Natterer and Leyden specimens are males, but the difference is apparently far too great to be merely sexual.

6. **Proechimys simonsi** *Thomas.*—This recently described species is represented by a single specimen, an adult female, which agrees perfectly with Mr. Thomas's description.

"I obtained this specimen on a tract of level land on top of the mountain range north of us. The land had been at one time covered with timber, and was an ideal place for mammals, but they proved to be very scarce, as this and No. 34 [*Didelphis pernigra*] were all I took during fourteen days with sixteen traps. Its stomach was empty."—H. H. K.

7. **Nectomys garleppii** *Thomas.*—Four specimens (3 males and 1 female, all adult), collected Nov. 1, 1899, and Jan. 3 and 7, and Feb. 20, 1900.

The collector's measurements from the fresh specimens are as follows:

16058, ♂,	Head and body, 214 ;	tail, 216 ;	hind foot, 51.
16057, ♂,	" " 241 ;	" 242 ;	" 51.
15801, ♂,	" " 240 ;	" 230 ;	" 54.
16059, ♀,	" " 253 ;	" 242 ;	" 57.

The female is wholly destitute of molar teeth in both jaws, and nearly all traces of their insertion have been obliterated by the filling of the former root-cavities by bony deposit.

"Taken in a pile of slide rock, caused by a landslide. It feeds on a green berry that is common here."—H. H. K.

8. **Neacomys spinosus** (*Thomas*). — Four specimens — 2 adult males, 1 adult female, and 1 'young adult' male—Juliaca, Nov. 8–13, 1899. In the adults the pelage of the ventral surface is uniform whitish or yellowish white to the base, the tips of the hairs suffused with buff, especially over the pectoral region. In

the young specimen the pelage of the ventral surface is plumbeous for the basal two thirds of its length. (*Cf.* Thomas, under *N. spinosus tenuipes*, in Ann. and Mag. Nat. Hist., 7th Ser., V, Jan. 1900, 153.)

These specimens agree so exactly with Mr. Thomas's original description (P. Z. S., 1882, 105) of this species, from Huambo examples, that their specific identity seems obvious, except that the fifth hind toe, exclusive of the claw, reaches to the end of the first phalanx of the fourth toe, instead of "barely to the middle of the first phalanx of the fourth toe." The only mammæ discoverable in the female are 4, two pectoral and two abdominal.

"All taken at the same place, under the edge of a bluff on a small gulch. When the skin is fresh the spines on the back come out very easily. I call this mouse Porcupine Mouse."—H. H. K.

9. Oxymycterus juliacæ, sp. nov.

Type, No. 15804, ♂ ad., Juliaca, Peru, Nov. 29, 1899; coll. H. H. Keays.

Above dark chestnut brown, grizzled with black, darkest along the median line, where over a portion of the middle of the back the prevailing color is black; sides lighter and more reddish; below dull brownish gray, with a faint tinge of buff, well defined from the reddish brown color of the sides; chin dull yellowish white; ears pale brown, well clothed on the inner surface with dusky hairs, nearly naked externally; upper surface of fore and hind feet blackish brown, the palms flesh color, the soles darker, more brownish; tail unicolor, dark brown, sparsely clothed with short bristly black hairs, scarcely at all concealing the annulations.

Measurements.—Total length, 250 mm.; head and body, 138; tail, 112; hind foot, 32, without claws, 29; ear (in dry skin), 13, from notch, 16.

Skull.—Nasals broadest in front, slightly trumpet-shaped or flaring upward at the end, and terminating posteriorly in a line with the lachrymals. The rostral portion of the skull is broad in proportion to the rest of the skull, which is rather narrow and elongate. Anterior zygoma-root low, narrow, and much rounded off on the antero-superior border. Interorbital region with rounded borders, and an incipient muscular ridge running from the orbit posteriorly. Interparietal very small. Palatal foramina rather large, terminating posteriorly in a line with the end of the first third of m^1.

Total length, 36.4; basilar length, 29; zygomatic breadth, 16; least interorbital breadth, 6.7; mastoid breadth, 14.8; nasals, 15; interparietal, 2 x 5.5; diastema, 8; palatal foramina, 7.8 x 3; upper molar series, 8.

The type and only specimen is an adult male in fine condition, with the teeth much worn, showing it to be an old adult, yet there is barely a suggestion of parietal ridges, and no trace whatever of any postorbital processes.

Oxymycterus juliacæ is evidently closely related to *O. inca* Thomas, agreeing very closely with it in size and proportions, but differs from it so much in the color of the underparts, and in certain cranial details, that the two forms seem unquestionably separable.

10. Oxymycterus apicalis, sp. nov.

Type, No. 16064, ♂ ad., Juliaca, Peru, altitude 6000 feet, Jan. 7, 1900; coll. H. H. Keays.

General color above dull blackish washed with gray, darker on the median area, lighter, more grayish on the sides, the hairs being there minutely tipped with gray; below gray brown, with a slight buffy tinge, most pronounced on the chest and throat, the hairs being pale plumbeous basally and broadly tipped with grayish white; lips and chin faintly rufescent; ears pale brown, very thinly haired; fore feet dusky brown, palms pale brownish flesh color; hind feet rather lighter above than the fore feet and more grayish brown, the soles dark brownish, much darker than the palms; tail uniform brown above and below, except that the apical fourth to third is white, in strong contrast with the basal portion, the whole so thinly haired that the annulations are distinctly visible.

Measurements.—Type, total length, 158 mm.; head and body, 148; tail, 158; hind foot, 36, without claws, 33.5; ear (in dry skin), from crown, 16, from notch, 21. Another specimen, ♂ ad., is somewhat larger, measuring total length, 350; head and body, 165; tail, 185; hind foot, 37. A very old female measures exactly the same as the type.

Skull.—The skull is of the usual *Oxymycterus* type, the interorbital region being smoothly rounded, the parietal ridges obsolete, the anterior zygoma root narrow and strongly rounded on the antero-superior border, and the palatine foramina very large. The nasals are very long, extending back considerably beyond the posterior border of the anterior zygomatic arch. The skull of the type measures as follows: total length, 38; basal length, 30; length of nasals, 17; diastema, 9; zygomatic breadth, 17.5; interorbital breadth, 8; mastoid breadth, 14.8; palatal foramina, 8.6 x 3.5; upper molar series, 6.

Oxymycterus apicalis is based on four specimens, two adult males, one adult female, and a 'young adult' female, all collected at Juliaca, Peru, Dec. 20, 1899, and Jan. 4–7, 1900, by Mr. H. H. Keays. He says "it seems to be the most common small mammal here."

This species is easily distinguished from any of its described congeners by its large size, blackish coloration, and very long, white-tipped tail. The white tail-tip is present in all the specimens, but varies in length from about one sixth to one third of the total tail length.

11. Oryzomys keaysi, sp. nov.

Type, No. 16062, ♀ ad., Juliaca, Peru, altitude 6000 feet, Jan. 7, 1900; coll. H. H. Keays, in whose honor the species is named.

Above yellowish brown, varied with black-tipped hairs, especially on the middle area of the back, lighter and more yellowish on the sides, and slightly grayish on the front of the head and nose, darker, almost blackish, around the eyes and at the base of the tail; below grayish white, in some individuals with a slight yellowish tinge on the breast; ears very large, dark brown, thinly clothed with short blackish hairs; feet dull grayish brown, the toes of the fore feet and the hind feet nearly naked; palms dull light brown, soles blackish brown; tail very long, naked, rather dark brown above, a little lighter brown below.

Measurements.—Total length (type), 355 mm.; head and body, 158; tail, 197; hind foot, 38, without claws, 35.8; ear (in dry skin), from crown, 18, from notch, 21, by 20 in width. Another specimen, an adult male, measures the same; three other 'adults' range as follows; total length, 305–335; head and body, 150–162; tail, 155–174; hind foot, 32–34.

Skull.—The skull is very heavily built in all its parts, with the supraorbital bead and parietal ridges strongly developed; and the interorbital plane is decidedly depressed in old specimens. Palatal foramina short and broad.

Total length (of type), 38.3; basal length, 29.5; nasals, 15; zygomatic breadth, 19; mastoid breadth, 14.3; interorbital breadth, 6; diastema, 9.3; palatal foramina, 6.5 x 3; upper molar series, 6. Several other rather younger skulls range in total length from 35–37.

This species is based on a series of five specimens, all taken at Juliaca, respectively, Nov. 6, Dec. 1, Jan. 2, 4, and 6, and are very uniform in coloration. The November specimen is in shorter and more worn pelage than the others, and for this reason is perhaps a shade darker. Mr. Keays refers to this as the "most common mammal of the region."

Oryzomys keaysi is of about the size of *O. prætor* Thomas, but appears to have a relatively longer tail, and differs from that species radically in coloration. It appears to have no very near known ally.

12. Oryzomys obtusirostris, sp. nov.

Type, No. 15811, ♀ ad., Juliaca, Peru, altitude 6000 ft., Dec. 6, 1899; coll. H. H. Keays.

General color above blackish brown with a faint yellowish wash, giving a slight general olivaceous effect, most pronounced on the sides, due to a slight fulvous tipping of most of the hairs; below dull buffy plumbeous, the buffy tinge strongest on the breast; ears black, well clothed with black hairs; hind

feet dusky brown above, blackish below; fore feet much lighter, both above and below; tail dark brown, slightly lighter below, especially proximally, practically naked, with very fine scutellation. A second specimen, a young adult female, is similar except that it is slightly more fulvous on the sides and less dark on the ventral surface.

Measurements.—Type, total length, 227 mm.; head and body, 100; tail, 127; hind foot, 27, without claws, 25. Another specimen, somewhat younger (the last molar not fully grown), measures, total length, 211; head and body, 98; tail, 113; hind foot, 27.

Skull.—The skull is rather short and broad, the rostral portion especially short, with short but broad palatal foramina. Supraorbital bead and parietal ridges well defined. The dentition is very heavy for the size of the animal. The type is a full-grown specimen, but the teeth are wholly unworn.

Total length, 30; basal length, 21.5; nasals, 10; zygomatic breadth, 16; mastoid breadth, 13; interorbital breadth, 5.3; diastema, 6; palatal foramina, 4.7 x 2.5; upper molar series, 6.

This species is represented by two females, one a young adult, the other not quite fully grown. It agrees nearest in size and proportions with *O. longicaudatus* (Bennett), from which it differs in coloration and in cranial characters.

13. **Akodon caliginosus** (*Tomes*).—Four specimens, taken Nov. 28 and 29, 1899, and Jan. 6 and Feb. 22, 1900, are referred provisionally to this species.

"I believe these little fellows migrate, as I had six traps sprung by them in one night along their apparent line of travel."—H. H. K.

14. **Sciurus æstuans cuscinus** *Thomas.*—Two specimens, taken Dec. 2 and 7, 1899.

Mr. Keays says that according to the miners these squirrels are quite generally distributed wherever there is timber, but are not numerous. The miners had never seen any before at so high an elevation.

15. **Nasua nasua** (*Linn.*).—A young male, about one fourth grown, is provisionally recorded under this name.

16. **Nyctinomus**, sp.—Two specimens, ♂ and ♀ ad., March 14, 1900, representing a species nearly related to *N. brasiliensis* I. Geoffroy.

17. **Myotis**, sp.—Two specimens, ♂ ad., Dec. 2, and ♀ ad., March 10. Nearly related to *M. oxyotus* (Peters), but clearly different. Apparently the two specimens represent two distinct species, distinguished by strong color differences, and by the distribution of the hair on the interfemoral membrane.

18. **Alouata nigra** (*E. Geoffroy*).—One specimen, an adult male, taken at an altitude of 5000 feet.

"I took this specimen from a band of about fifty. They were the first I had seen. They travel by swinging from tree to tree. As the specimen fell dead, the rest of the band did not appear to be frightened by the noise of the gun. Two of them dropped down from the tree to the ground where the dead one lay, picked him up and stood him against the tree, as though they expected him to climb it. Then they seemed to realize that he was dead, and, dropping him, began to chatter ; then the whole band took up the cry and scampered off through the treetops. The stomach was partly filled with green leaves."—H. H. K.

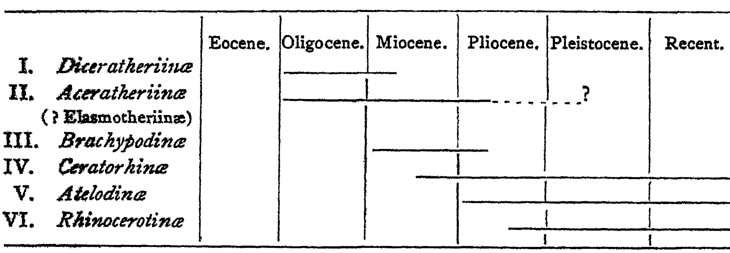
Article XIX.—PHYLOGENY OF THE RHINOCEROSES OF EUROPE.

RHINOCEROS CONTRIBUTIONS, No. 5.[1]

By HENRY FAIRFIELD OSBORN.

By far the most striking generalization of recent mammalian palæontology is the *early separation*, *absolute distinctness*, *and great age of numerous phyla leading up to modern types.* If confirmed by more detailed research, the phylogeny here proposed will bring the Rhinoceroses also under this *law of early divergence;* the supposed original or stem forms having been pushed steadily back into the older Cenozoic. It sets aside several homoplastic characters heretofore employed in Rhinoceros evolution and attempts to establish a firmer basis *in the fundamental proportions of the skull*, *whether dolichocephalic or brachycephalic*, *in the correlated proportions of the body*, *and in the location of the horn-cores.* These characters are found to be more distinctive of phyla than the pattern of the molar teeth.[2]

Our present hypothesis is that, as distinguished from the Amynodonts and Hyracodonts, *the true tertiary and modern Rhinocerotidæ belong to at least six*[3] *genetic series or phyla which have no known relation to each other.* By Flower and Lyddeker the Rhinoceroses have been placed in one genus, *Rhinoceros*, and divided into five groups, which correspond approximately to our phyla. A characteristic subfamily name is herein given to each phylum, for the sake of clearness, brevity, and convenience, since several of these series have a prodigious range in time, as shown in the following table.



[1] See Contributions 1–4, in Bibliography.

[2] The grouping proposed by Depéret ('85, p. 268) and by Lydekker ('86) is partly upon homoplastic characters of the teeth.

[3] See Osborn, '98, pp. 77, 121; a division of the Rhinocerotidæ into *four* subfamilies.

If this or some similar phylogenetic hypothesis can be established, it will not elucidate the origin, which remains an enigma, but it will at once simplify the whole problem of the succession, development, migration, and taxonomy of this hitherto baffling group.

PHYLOGENY AND TAXONOMY.

A clear conception of phylogeny is an essential preliminary to taxonomy; the nomenclature is still, as my friend Schlosser expresses it, "ein wahres Elend"; in no European or American museum are the Rhinoceroses properly identified or catalogued. This paper therefore, besides setting forth an hypothesis of descent, is a preliminary statement of very interesting systematic and comparative results obtained by visits in 1898 and 1900 to the collections of London, Paris, Lyons, Munich, Darmstadt, Stuttgart, Augsburg, Vienna, St. Petersburg, and Moscow. Many kind friends aided in this work, especially the following palæontologists: Messrs. Lydekker, Woodward, Andrews, Gaudry, Boule, Thévenin, Depéret, Filhol, Zittel, Schlosser, Roger, Lepsius, Fraas, and Fritsch. The recent writings of Lydekker, Pavlow, and Roger have been of great service.

This extended comparison was undertaken before writing Part II of 'The Extinct Rhinoceroses' memoir, because in studying the American Rhinoceroses I soon learned that their close relations with those of Europe rendered it necessary for me thoroughly to understand the types of both countries.

The stratigraphical or geological basis is of the utmost importance and is set forth in recent correlation papers (Osborn, '00).

As regards nomenclature: first, the discovery that the type Acerathere, the classic *Aceratherium incisivum* Kaup, has *a rudimentary median frontal horn*, does away with the application of the generic term *Aceratherium* to many of the ancestral hornless types; second, valid reasons are found for reviving the discarded generic terms *Atelodus*, *Ceratorhinus*, etc., and, third, the final nomenclature will be an expression of phylogeny. The first steps towards clearly attacking the taxonomic problem are:

(1) To conceive of the early adaptive radiation of the Rhinoceroses from an unknown stem.

(2) To conceive of the possibly independent origin of certain

phyla in North America, Europe, Asia, or Africa, and the subsequent intermingling of these phyla by migration.

(3) To recognize the succession of species in separate phyla or lines of descent, designating them as subfamilies by the terminal *inæ*.

(4) To sharply mark off each subfamily or phyletic series of species from its contemporaries as soon as its earliest members appear.

(5) To anticipate within each phylum the probable development of *collateral* as well as of *direct* lines of species, by the laws of local adaptive radiation.

Among the main divergent characters for the discrimination between subfamilies or series of species are :

1. *Proportions :*
   a. Long-skulled (dolichocephalic), and long-footed (dolichopodal), or long-limbed types, *e. g.*, *Atelodus simus.*
   b. Short-skulled (brachycephalic), short-footed (brachypodal), or short-limbed types, *e. g.*, *Teleoceras fossiger.*
2. *Reduction of digits :*
   a. Precociously tridactyl types, *e. g.*, *Cænopus tridactylus.*
   b. Persistently tetradactyl types, *Aceratherium tetradactylum.*
3. *Development of horns :*
   a. In lateral pairs on nasals, *e. g.*, *Diceratherium pleuroceros.*
   b. Single on nasals, *a*, on tips, *e. g.*, *Teleoceras*, *b*, on centre, *e. g.*, *Rhinoceros.*
   c. In longitudinal pairs on nasals and frontals, *e. g.*, *Ceratorhinus.*
   d. Single on frontals, *e. g.*, *Aceratherium incisivum*, *Elasmotherium.*
4. *Cutting teeth :*
   a. 'Megalodine types,' in which the cutting teeth persist, *e. g.*, *Rhinoceros indicus.*
   b. 'Atelodine types,' in which they degenerate, *e. g.*, *Atelodus simus.*

Some of these *divergent* characters also become *convergent* or *homoplastic* and are employed to distinguish the generic and

specific stages of several distinct subfamilies or phyla. Thus several 'megalodine' types gradually pass into 'atelodine.' Correlated with the above fundamental divergent characters are numerous minor characters which are of great service; for example, dolichocephalic and brachycephalic Rhinoceroses frequently exhibit also distinctive types of auditory meatus, of occiput, of premolar and molar teeth, and of limbs.

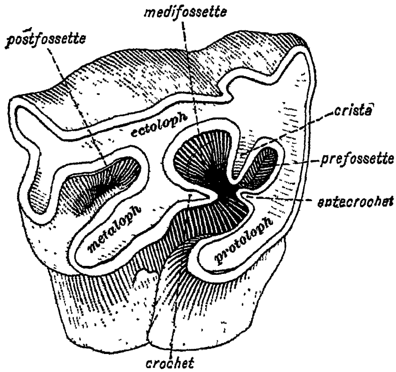


Fig. 1. Typical Rhinoceros molar, showing terminology.

An early division is observed into *heavier* and *lighter* types, correlated with speed; while *collateral brachyodont* (shrub-eating) *and hypsodont* (browsing) *species may arise within the same phylum*; example, *A. simus* and *A. bicornis*.

Family RHINOCEROTIDÆ.

Oligocene phyla.—Two similar lines appear simultaneously in the Oligocene of Europe; the most precocious of these is the subfamily Diceratheriinæ, represented in Europe and America; the less precocious is the Aceratheriinæ, probably represented in both countries also. The characters of both are sharply defined. It is probable but not yet demonstrated that the smaller Rhinoceroses throughout the Oligocene chiefly represent the Diceratheriinæ; nevertheless it is best to leave certain species *incertæ sedis* (*R. velaunum*, *R. gaudryi*), one or both of which may belong to the Amynodontidæ.

Subfamily DICERATHERIINÆ. PHYLUM I.

Smaller Oligocene Rhinoceroses; dolichocephalic, with paired nasal horns, full-sized cutting teeth; cursorial, long-limbed, with relatively slender bodies well raised from the ground.

General characters.—1. Manus precociously tridactyl (as observed in American species), correlated with swift motion. 2. Horns developed in lateral pairs

on the nasals, beginning in the Middle and Upper Oligocene stages. 3. Lower canines sub-triangular in section, flattened on outer and upper sides, slightly convex on lower side (as observed in Middle and Upper Oligocene American and European types). 4. First lower premolar early reduced or wanting, as observed in European and American types (also in *R. gaudryi* and *R. velaunum*). 5. Molars quadrate, frequently exhibiting a conical cingule or cusp at the opening of the median valley. 6. Narrow skull, with narrow elevated occiput, expanding and notched above. Zygomatic arches suddenly expanding posteriorly.

These are some of the characteristic features which are observed in both European and American types and reach their full development in the Upper Oligocene. The nomenclature is

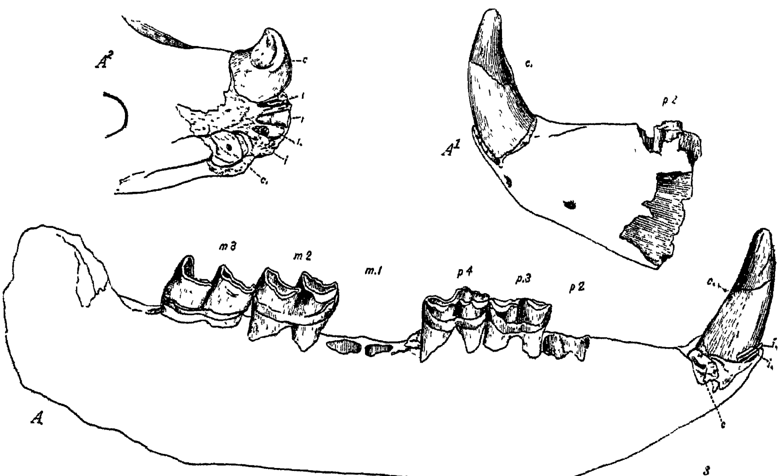


Fig. 2. *Ronzotherium gaudryi.* Type: PARIS. *A*, Internal view of left ramus. *A*¹, External view. *A*², Superior view. × ⅜.

still uncertain; to the Lower Oligocene forms, which probably possessed upper canine teeth, the generic name *Ronzotherium* Aymard possibly applies. It is possible that the type species, *R. velaunum*, belongs to the Amynodontidæ, in which case it may anticipate the genus *Amynodon* Marsh. If, however, it belongs to the Diceratheriinæ it may anticipate the genus *Cænopus* Cope (primitive hornless Rhinoceroses with precociously tridactyl feet), or the genus *Leptaceratherium* Osborn, or *Trigonias* Lucas (primitive hornless Rhinoceroses with persistent upper canine teeth). To the Upper Oligocene form, *Diceratherium* Marsh is applicable.

1. Lower Oligocene. Incertæ Sedis.

Ronzon, Argiles du Cantal, Phosphorites, Cadibona.

A most interesting primitive Lower Oligocene type is:

Ronzotherium gaudryi *Rames.* Type: a lower jaw, Paris Museum. Locality, Brons, Cantal. Definition: dentition $\frac{}{2}\ \frac{}{1}\ \frac{}{3}\ \frac{}{3}$; second pair of lower incisors greatly reduced; median or first pair typical; lower canines erect, laterally compressed; first lower premolars wanting; premolars 3–4 with internal and external cingulum; molars 2–3 without internal cingulum; premolars 2–4 much worn but apparently simple in pattern, *i.e.*, without complete posterior crests.

Systematic Position.—The *erect* lower canines indicate the existence of upper canines, as in the Amynodontidæ or in *Leptaceratherium trigonodum* Osborn; the laterally compressed shape of the canines resembles that in *Leptaceratherium* and is distinct from the more triangular form seen in *Amynodon*, but, if a member of the Rhinocerotidæ, this animal was very primitive. Since it is certainly not a member of the genus *Aceratherium* it may be provisionally referred to the genus *Ronzotherium* Aymard, the type of which is a lower jaw from Ronzon, similar in some respects. The absence of the first lower premolar in *R. gaudryi* and *R. velaunum* is also distinctive of the Diceratheriinæ.

According to M. Boule the Argiles du Cantal, containing *R. gaudryi*, are, if anything, a shade older than the Marnes de Ronzon, containing *R. velaunum*.

The jaw is slightly smaller than that of *R. velaunum*,[1] there is a wider space behind the third molar; the dentition is similar in the simplicity of the premolar teeth; in fact it may subsequently prove that *R. velaunum* and *R. gaudryi* are allied.

Space occupied by lower grinding series, premolar 2 to molar 3 inclusive	*Ronzotherium gaudryi*.....170 mm.
	(estimated) *Ronzotherium velaunum*...194 mm.

The lower grinding series of *R. gaudryi* is closely equal in size to that of the Upper Oligocene *D. minutum* series (p2–m3 = 173) in the Paris Museum.

Ronzotherium velaunum *Aymard.*—Type: A lower jaw, Collection Aymard, Puy Museum. The writer has not personally examined the type and must rely upon the descriptions and figures

[1] M. Filhol gives no measurements but figures the jaw of *R. velaunum* as $\frac{3}{4}$ natural size (Plate xii, figure 69, pp. 75, 266, Mammifères Fossiles de Ronzon).

(Fig. 3) given by M. Henri Filhol; as above stated the incomplete condition of the jaw leaves it uncertain whether this animal

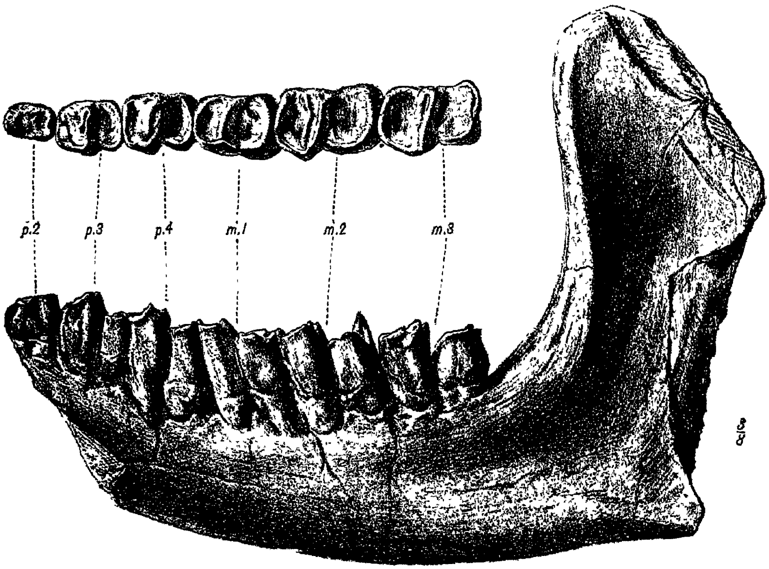


Fig. 3. *Ronzotherium velaunum.* Type: PUY. External view of left ramus. $\times \frac{3}{8}$, after Filhol.

from the Lower Oligocene of Ronzon is a primitive member of the Diceratheriinæ, Aceratheriinæ, or Amynodontidæ.

Characters.— Premolars 2, 3, 4, with incomplete crests; premolar 1 missing in the type specimen; coronoid and condyle greatly elevated (as in *Amynodon*); tetradactyl, fifth digit of manus believed to be present (as in *Amynodon* and *Aceratherium*).

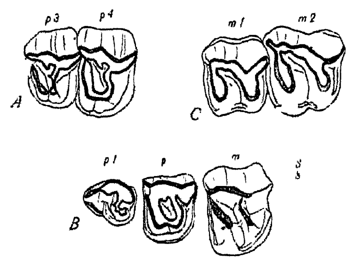


Fig. 4. Superior grinding teeth. *A*, Third and fourth premolars, *Cadibona*, MUNICH. *B*, First and fourth premolars, first molar, *Phosphorites*, MUNICH. *C*, First and second molars, *Phosphorites*, PARIS. All figures $\times \frac{3}{8}$.

It should be noted that the American Diceratheres of the Lower Oligocene are tridactyl; the American Amynodonts (Cadurcothériidæ or Amynodontidæ) are tetradactyl, but with a much larger fifth digit than that associated by Filhol with *R. velaunum*.

The most primitive species of American Rhinoceros, *Trigonias osborni*, recently described by Lucas, presents an entirely different type of cutting teeth from that seen in *R. gaudryi*.

SUPERIOR MOLARS OF DICERATHERIINÆ.

In London, in Paris, and in Munich are numbers of small extremely primitive molar and premolar teeth from the Middle and Lower Oligocene Phosphorites of Mouillac, Quercy, and Bach, also from the Lignites of Cadibona, which are for the most part erroneously catalogued as *D. minutum* and its synonym, *D. croizeti*, *specific names which were applied originally to much more highly evolved Upper Oligocene types.* In point of evolution all these upper grinding teeth resemble the Lower Oligocene Diceratheré types of America, especially such species as *Cænopus* (*Aceratherium*) *copei;* but, as in the case of the lower jaws (of *R. gaudryi* and *R. velaunum*) above described, it is not possible to determine their phyletic relations or exact systematic position at

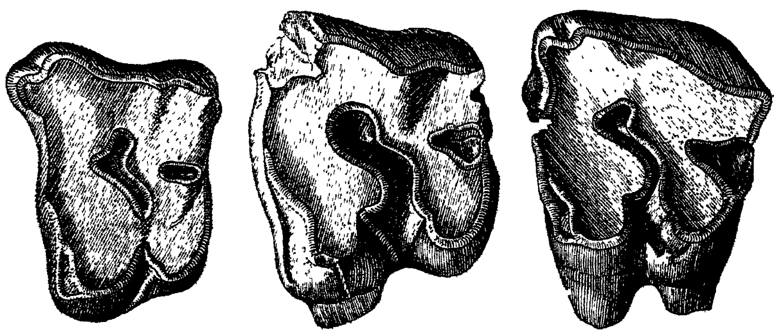


Fig. 5. *Diceratherium minutum.* Type: PARIS. Fourth premolar, first and second molars. × ½. After Cuvier.

present. It is probable that all these teeth belong either to *R. velaunum*, *R. gaudryi*, or some allied species. (See Fig. 4.)

Characters.—Dentition: premolars unlike molars; premolars 2–4 with proto- and metalophs confluent upon wear; a crista in premolars 3–4; *milk premolars* dp^2–dp^4 with complete crests resembling the molars; *molars* with rudimentary antecrochet (protoconule fold); more or less marked external cingulum, rudimentary metaconule fold; variable cingulum suggesting a 'cingule' at entrance of median valley (Fig. 4).

LONDON, British Museum Collection: No. M. 1732, superior molars 1 and 2, Loc., Phosphorites, Bach, Lalbenque (Lot), France (see Fig. 17, Lydekker,

Cat. Foss. Mamm. Pt. III, p. 142); also No. M. 4507, superior deciduous premolars 1–4, Loc. Phosphorites, Mouillac, France. In the MUNICH collection from *Cadibona* are two small upper premolar teeth, pm 3–4, which answer this description; others from the Phosphorites, Quercy, are found in the Munich collection (m^1, m^2, pm^1, pm^3). In PARIS[1] from *Quercy* (Coll. Massénat) are also small isolated premolar and molar teeth (p^1–m^2) of the same character, found both in the Jardin des Plantes and the École des Mines collections.

Conclusions.—The *small* European Lower Oligocene species of Rhinoceroses, although *incertæ sedis*, are partly Diceratheriinæ, partly Amynodontidæ; they should be referred to *R. gaudryi* or *R. velaunum* or to new species. The *large* Lower Oligocene species of the Phosphorites should be referred to the Aceratheriinæ.

2. UPPER OLIGOCENE.

St. Gerand-le-Puy, Moissac, Gannat, Eselsberg (Ulm), in part.

Diceratherium minutum *Cuvier.*—Type: Upper premolar 4 and molars 1–2. PARIS, No. 2346, Loc., Moissac, Upper Oligocene (Fig. 5).

Definition: Dentition $\frac{1}{1}\,\frac{0}{1}\,\frac{4}{4-3}\,\frac{3}{3}$; upper incisors small; lower canines sub-triangular; with flat outer and sharp inner edge, procumbent; first lower premolars variable; upper and lower premolars 2–4, with two crests resembling the molars; upper premolars with small antecrochet, with crista and crochet; upper molars with crista (soon disappearing), pointed crochet (disappearing in old age), antecrochet and postfossette; cusp or cingule at entrance of median valley. Measurements: type p^4–m^2 = 100; p_2–m_3 = 173; p^2–m^3 = 173–180.

This represents the Upper Oligocene species of the French and German Museums, which are readily distinguished from the Lower Oligocene species by the complication of the teeth; but exhibit little or no increase in size. In PARIS are Cuvier's types described in the 'Ossemens Fossiles'; also a cotype lower jaw No. 2343; also Duvernoy's *R. pleuroceros* (synonym) type skull from Gannat. The finest series of upper and lower teeth are those in the MUNICH collection from Eselsberg and Eckingen near Ulm, which are catalogued as *A. croizeti* Pomel. In the STUTTGART collection from the same localities we find especially Nos. 4757 and 9861, rightly identified as *D. minutum.*

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[1] Unless otherwise stated PARIS refers to the Galerie de Paléontologie, Jardin des Plantes, under the direction of Professor Gaudry.

Additional Characters.—PARIS: *Cuvier's type:* Fourth superior premolar with protoloph and metaloph confluent in old age, small antecrochet; molars with antecrochet, crochet, metaconule fold, postfossette, and median internal cingule. *Duvernoy's type* (*R. pleuroceros*): molars agreeing precisely in size with above; skull and jaws of dolichocephalic type, paired horn-cores on nasals, occiput narrow elevated; zygomatic arch convexity as in *Cænopus tridactylus* Osborn. In the Paris jaw (Gannat) the first lower premolar is wanting, in Munich and Lyons specimens it is vestigial, indicating that, as in the American Diceratheriinæ, this tooth was variable; m 1–m 3 = 100. Tibia (Gannat) = 260. MUNICH and STUTTGART (Eselsberg, Ulm, specimens): first lower premolar very small; pm 2–4 molariform with elevated posterior crests; lower canines sharp, subtriangular with flattened outer surface, flat upper face partly destitute of enamel, slightly convex lower face and sharp inner edge; canines large in males, small in females (this tooth is very similar to the canines of the American species *C. tridactylus* Osborn); unworn *premolars* (catalogued *A. croizeti*, Munich) as in Cuvier's type without antecrochet, but with crista and pectinate crochet (see Nos. 4757, 9861, STUTTGART, Eggingen); *unworn molars* exhibit crista, crochet, and antecrochet, while *worn molars* lose crista and show greater prominence of antecrochet and crochet, and postfossette (especially in p 4–m 2), also an internal cingule or cusp in the median valley as in American Diceratheres. This animal is exactly the size of *Cænopus mite* of the American Lower Oligocene. LYONS: A small jaw (catalogued *A. croizeti*) with vestigial pm 1.

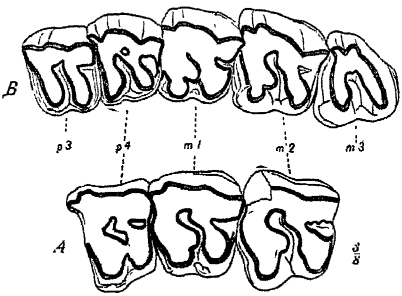

Fig. 5*a*. *Diceratherium minutum*. *A*, Type premolar and molars. × ⅗. PARIS. *B*, Part of left superior grinding series. Ulm, MUNICH.

Affinities.—By this comparison there is little question that all these teeth belong to the Upper Oligocene *Diceratherium* and, so far as we know, to the single species *D. minutum* Cuvier, which presents many features of close resemblance to the American Diceratheres. In Paris the skull of the Upper Oligocene *D.* (*Pleuroceros*) *minutum* is now placed in the case side by side with that of the Middle Oligocene *Cænopus occidentalis* from South Dakota; it exhibits a remarkable similarity in the form of the occiput, the zygoma, and the paroccipital region.

3. Lower Miocene.

Sables de l'Orléanais, Eselsberg (Ulm, in part), Bugti Beds.

The Eckingen, Ulm, formation also contains a Lower Miocene fauna, indicating that the Diceratheres may have persisted into this period.

Other indications as to Miocene persistence are those afforded by a juvenile lower jaw and a maxillary series in the École des Mines collection, Paris, from the Sables de l' Orléanais, typical Lower Miocene; these were kindly shown the writer by the Curator, M. Douvillé; they are of about the size of *A. platyodon* Mermier, but they almost certainly constitute a new species which probably belongs in the Diceratheriinæ. The animal is considerably larger than *D. minutum*.

Incertæ Sedis.

Diceratherium douvillei,[1] sp. nov.

Type: A maxillary series Coll. École d. Mines, Paris. Definition: Type: Upper premolars with crenulated anterior border of metaloph, and reduced antecrochet; upper molars with large crochet and antecrochet, crista not apparent in worn teeth.

Fig. 6. *Diceratherium douvillei.* Type: Paris. After a photograph by M. Douvillé.

This species is placed *incertæ sedis*, phyletically. The indications that it belongs to the Diceratheriinæ are, first, the crenulated or pectinate anterior border of the metaloph in the upper premolars as in *C. tridactylus;* second, the tubercle in the valley of

[1] Dedicated to M. Henri Douvillé, to whose kindness the author is indebted, both for the permission to describe the type and for the accompanying photograph (Fig. 6).

m^3. It is also possible that it represents an ancestor of *R. sansaniensis*, which is placed in the *Ceratorhinæ* below. It certainly is not *Teleoceras aurelianensis*, and it apparently cannot be referred to *Aceratherium platyodon*; these are the only strictly Lower Miocene (Burdigalien) Rhinoceroses hitherto described in France.

Subfamily, ACERATHERIINÆ. PHYLUM II.

Large Oligocene and Miocene Rhinoceroses of Europe; dolichocephalic with long, narrow nasals; smooth or with rudimentary horns at sides of the tips; frontals finally developing horns; large cutting teeth; relatively persistent tetradactyl manus; long-limbed.

Contemporary with the small Diceratheres is this phylum of large Rhinoceroses which appears to rise in a large but primitive species in the Lower Oligocene, *A. filholi*, and pass through *A. lemanense* and *A. tetradactylum* into *A. incisivum* of the Lower Pliocene, which in turn is possibly the ancestor of *Elasmotherium* and the Elasmotheriinæ. The European Lower Oligocene Acerathere is exactly similar in size to *A. platycephalum* Osborn, which is possibly the American representative of this type; but it differs widely in the mode of transformation of the upper premolar teeth; for this reason it is referred to a new species.

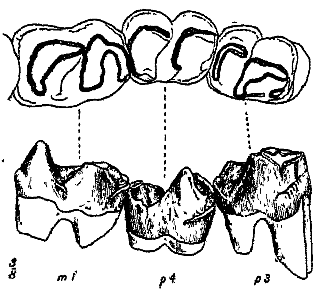

Fig. 7. *Aceratherium filholi.* Cotype: PARIS. Lower third and fourth premolars and first molar.

1. LOWER OLIGOCENE.

Phosphorites, Quercy, Cazark, Escamps.

Aceratherium filholi,[1] sp. nov.

Type: Left maxilla containing second premolar to third molar inclusive; Paris, Coll. Rossignol, Loc. Phosphorites. Cotype: Paris, lower jaw, containing pm^3, pm^4, and m^1 (Figs. 7, 8*A*).

Definition: Large upper premolars, simple, unlike molars, with incompletely formed crests; upper molars with internal cingulum and strong protoconule fold, small antecrochet, no crochet; depression in posterior face of metaloph of third

[1] Dedicated to my friend M. Henri Filhol, who has contributed so extensively to our knowledge of the fauna of the Phosphorites.

molar; third and fourth lower premolars with depressed and incomplete posterior crests. Measurements: $pm^2-m^3=224$.

This new species is well represented by teeth in the Paris, Munich, and British Museum collections from the Phosphorites of Quercy and Cazark, mistakenly catalogued as the Upper Oligocene *A. lemanense*, from which it differs widely. No true *A. lemanense* remains are found in the Phosphorites, which is believed by the writer not to extend into the Upper Oligocene. None the less *A. filholi* is probably ancestral to *A. lemanense* and represents the first known member of the tetradactyl, dolichocephalic phylum which directly or through collaterals leads up to *Aceratherium incisivum* of the Lower Pliocene.

The distinctness of this species was independently recognized by M. Boule, who in recent lectures has compared it with *A. platycephalum*. M. Filhol and M. Depéret also both concur with the writer that it is distinct from *A. lemanense*, and M. Filhol assures me that it is equally distinct from *R. velaunum*, which is a much smaller animal. The name *Aceratherium* may be retained for all members of this phylum, although technically the names *Badactherium* Croizet or *Aphelops* Cope might be applied to the ancestral truly *hornless* Aceratheres.

The entire absence of a crochet and the non-molariform premolars distinguish this species sharply from *A. lemanense*; the internal cingulum is partly a sexual character; it varies in different specimens, although strongly marked in the type.

Besides the admirably preserved and highly characteristic PARIS types, in MUNICH we find two large molar teeth, m^2 and m^3 from the Phosphorites (Escamps, Lalbenque, Dép. Lot); also a single well worn molar, m^2, and two isolated upper molars, m^1 (Phosphorites, Cazark, Dép. Lot), of exactly the same size as the *A. platycephalum* from our Lower Oligocene; also from Cazark two upper premolars, p^3, p^4, which exhibit imperfectly formed crests and a crista. In LONDON (British Museum) are lower premolars and molars (Phosphorites, Caylux, Nos. M. 1457, 1458, 1459, also upper molars M. 1455, m^1-m^2) all catalogued *R. lemanensis*. There can be no question that all these teeth belong to the same species, *A. filholi*, which is far more primitive than the Upper Oligocene *A. lemanense* to which they have been referred; not only the premolars but the molars are simpler. The premolar

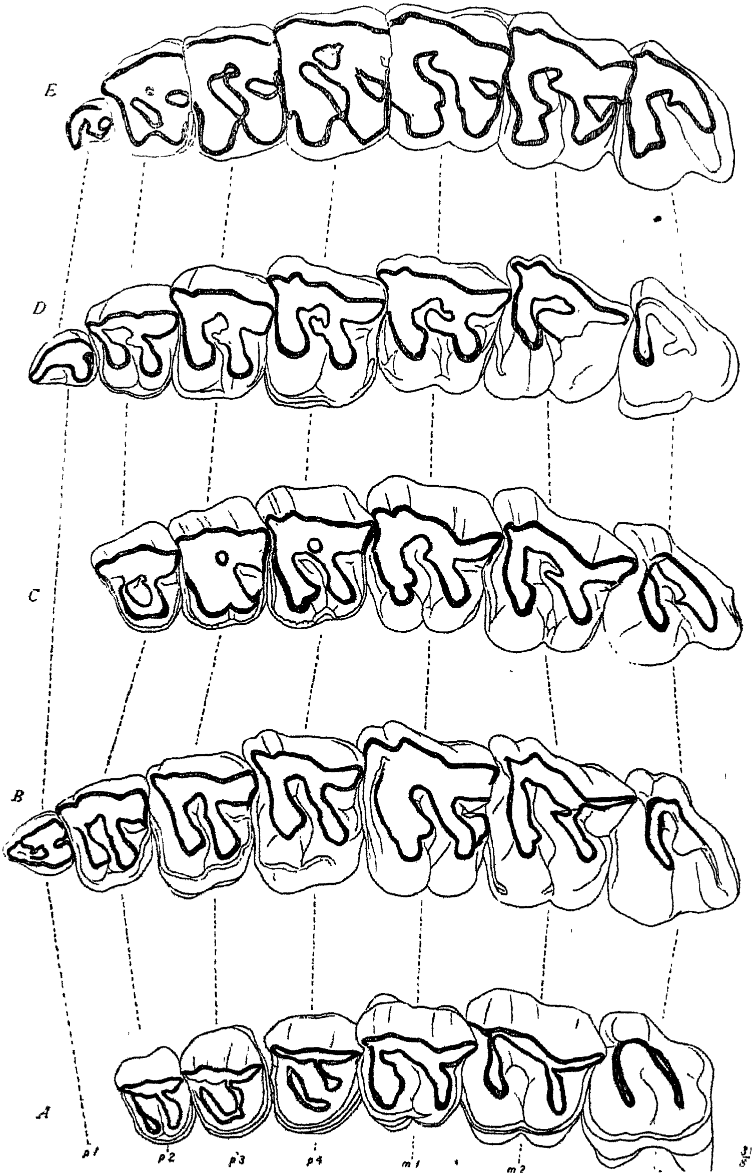

Fig. 8. Evolution of the grinding teeth in the Aceratheriinæ. *A*, *Aceratherium filholi*. Type: PARIS. Lower Oligocene. *B*, *Aceratherium lemanense* (reversed). PARIS. Upper Oligocene. *C*, *Aceratherium lemanense*. Ulm, MUNICH. Upper Oligocene. *D*, *Aceratherium tetradactylum*. PARIS, No. 2379. Middle Miocene. *E*, *Aceratherium incisivum*. Type: DARMSTADT. Lower Pliocene. All contours, × ⅜.

evolution differs from that of the American *A. platycephalum* as shown in the diagram above (Fig. 8); other resemblances, however, are so strong that one is tempted to consider the *possibility* that these animals belong to the same Aceratherine race which is distinct from, but contemporary with the Diceratherine race. A fossa representing the vestige of the postvallum in m^3 is seen in these specimens, also in *A. platycephalum.*

2. Upper Oligocene Stage.

St. Gerand-le-Puy, Gaillac, Gannat, Randan, Eckingen, (Ulm).

A. lemanense *Pomel.*—This well known species is represented by superb materials in Paris, Lyons, Munich, Stuttgart. These specimens represent different (early or primitive and later) stages of development; some are less progressive and probably of Middle Oligocene age, others are more modernized and probably of Lower Miocene age, but in all the premolars and molars are far more advanced than in *A. filholi.*

Sexual differences are pronounced as in the Diceratheriinæ and Rhinoceroses generally; the females have small canine tusks and long very narrow or slender nasals; the males have large tusks and rudimentary rugosities or horn supports on the sides of the extremities of the nasals. Adaptive radiation is also marked and probably certain *collateral species* are given off from the direct line.

All these animals are readily distinguished from the Diceratheriinæ by much larger size.

General Distinctions of Teeth.—Lower canines lance-shaped, lenticular in section; first lower premolar small, usually present; *superior premolars* with crista, producing a medifossette upon extreme wear; large antecrochet; premolars 2–4 with complete crests, which in the more primitive stages unite in extreme wear; an internal cingulum. *Molars* with strong antecrochet, becoming stronger in wear; with crista becoming weaker in extreme wear; crochet also becoming weaker with extreme wear; metaconule fold becoming stronger with wear; protocone small; postfossettes indicated in both m^1 and m^2, with internal cingulum reduced or confined to median valley. Measurements: pm^1–m^3=265.

Effect of age upon molar pattern.—It is extremely important to observe that, exactly as recorded above in the Diceratheriinæ,

the *newer characters*, namely the crista and crochet, are formed near the summit of the crests and are thus worn away in old teeth ; while the *older characters*, such as the antecrochet, are at the base of the crests and thus become bolder in extreme wear. The same law applies to the newer and older characters in the molar teeth of the horse.

General Distinctions of Skeleton.—Skull and jaw of dolichocephalic type (measurements, symphysis to condyles=630) ; nasals long and narrow, more or less separate, notched at sides, slender in females ; tetradactyl, a well developed 5th metapodial, lunar wedge-shaped distally ; symphysis of lower jaw varying with sex, short in females, longer in males.

These characters may be verified in the following specimens : PARIS, No. 2372 (*Badactherium*[1] *borbonicum* Croizet, type, loc. Auvergne), an old individual with well worn molars. Duvernoy's fine type skeleton of *A. gannatense* (Gannat, Allier), probably a *female*, with small lower canines and short symphysis of lower jaw, large and powerful skeleton ; skull measuring 630 from symphysis to condyles ; superior teeth partly worn and finely preserved ; pm^1–m^3=265 ; femur measuring 460. Also *A. randanense*, No. 2302 (Randan, Auvergne), lower jaw containing pm 2–m 1, with a very long symphysis (unlike the *A. gannatense* type) ; this is possibly a sexual or *male* character. Also a complete jaw (Gaillac, Tarn) with small lower canines, probably *female*, small pm 1 on left side. Portion of left anterior foot, No. 2373 (Gannat, Allier), showing characteristic tetradactylism.[2] LYONS : (1) *A. lemanense* (Gannat), skull, nasals long and thickened at the ends, but separate in median line, notched at the sides ; this type represents an *early stage*, because the premolar crests are bridged internally and would unite upon extreme wear. (2) Large lance-shaped lower canines of lenticular section, unworn (Allier). (3) Two maxillæ from Gannat exhibit molar and premolar characters entirely agreeing with those above described. (4) A complete skull and skeleton, probably *female*, lower jaw with small canines, medium-sized upper canines, molars agree with Pomel's type in character, size below that of Pomel's type ; nasals extraordinarily long, slender, extend-

[1] This is possibly a MS. name. It is not recorded in Trouessart's 'Catalogus Mammalium.'
[2] See Duvernoy's Memoir, Plate viii.

ing over premaxillaries, with smooth surfaces (this length, slenderness, and smoothness is also a female character in *C. occidentalis* and *C. tridactylus*); a sagittal crest, occiput high and narrow. (5) Another skull (loc. Pyremont between Lyons and Geneva) has the same general characters but the nasals exhibit distinct and quite well marked rugosities at the sides of the tips; this is evidently a *male;* the digits are somewhat shorter than in *A. lemanense*, namely, Mtc. III=140, Mts. III=125; Depéret regards the animal as a distinct species and will describe it as such. MUNICH: (1) The maxilla from Eselsberg, Eckingen, near Ulm, is beautifully preserved; it belongs to an *early stage* because the premolar crests are bridged and unite when worn; the premolars exhibit medifossettes; the molars show the strong crochet, antecrochet, and metaconule folds. (2) An unworn molar from Eckingen shows a crista, antecrochet, and crochet, and the characteristic small protocone of this species. STUTTGART: (1) Molars of a *later stage* (Eggingen, Ulm) show a more prominent crista and crochet which unite to form a medifossette. (2) A fine pair of lower jaws (Ulm) with large lower canines and no traces of pm 1 probably also represent a later stage (*i. e.*, Lower Miocene).

We thus find that *A. lemanense* is the characteristic Upper Oligocene species, presenting various stages of premolar transformation and probably giving rise to some collateral species.

3. LOWER MIOCENE STAGE.

Sables de l' Orléanais, Royans.

A. platyodon *Mermier*, represents this stage.—LYONS: The type skull, probably belonging to a small female, pm^1–m^3=207, exhibits unique, extremely elongate, slender, and slightly separate nasals; the lower canines, as the specific name indicates, are excessively flattened toward the extremities but exhibit a triangular mid-crown section; the premolars (Mermier, '96, Pl. II) have a prominent crista and medifossette; the crests unite early upon wear. The teeth may be readily distinguished from those of the contemporary Brachypodinæ by the small size of the protocone.

A. blanfordi *Lydekker*.—A jaw is ascribed to this species

(Lydekker, '86) from the Lower or Middle Miocene Bugti Beds of Sind. It is *incertæ sedis* here.

4. Middle Miocene Stage.

Sansan, Simorre.

A. tetradactylum *Lartet.*—This is the noble species of Sansan (Nos. 3378 male, 2379 female, 2389 female, etc.) and Simorre, represented finely in the Paris Museum. It shows striking resemblances to *A. lemanense*, together with all the progressive characters which we should expect to find in a descendant, and unquestionably belongs to the same line. The scapula is high and narrow as in dolichopodal types generally. The hind limb

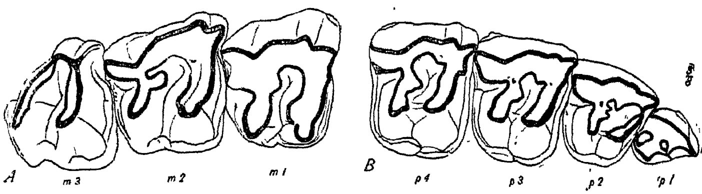

Fig. 9. *Aceratherium (incisivum) tetradactylum.* Georgensgemünd. Munich.

(femur and tibia) is of approximately the same length as in *A. lemanense*, but the metapodials are longer, and more stilted (Mtc. III=160–180, Mts. III=135–165), indicating that the phylum was developing a progressive running power. The progressive and retrogressive changes in the skull and jaws are most interesting and significant as seen in a magnificent male specimen (No. 3378, Loc. Sansan). As compared with *A. lemanense* note the following

Skeletal Distinctions.

Skull.—A slight loss of size, symphysis to condyles of skull = 559, *A. tetradactylum*; symphysis to condyles of skull = 630, *A. lemanense.* Nasals, *males* (No. 3378) slightly less elongated, similarly notched at sides, roughened or rugose distally, but not thickened (a sexual character); *females* (Nos. 2379, 2389, Coll. Lartet) very narrow and elongate, separate in median line, not expanding distally. Premaxillæ slender. Occiput elevated, spreading superiorly. Sagittal crest lower but still well marked. Premaxillæ slender. Jaw with elongate symphysis, wide diastema, angle deep, projecting backwards. Manus tetradactyl (Coll. Lartet, Nos. 2518, 2537), with reduced metacarpal V; lunar of tridactyl type (foreshadowing the loss of metacarpal V, which is now reduced

in length to 75), PARIS, Coll. Lartet, Nos. 2518, 2537; long, stilted digits; metacarpal III enlarged: metacarpals II, IV relatively smaller. Scapula vertically elongate, with long neck, as in all long-limbed, speedy types.

Dental distinctions.—Inferior canines less lance-shaped, with internal flare and flattened external section. First lower premolar sometimes present (in the slightly older Sansan specimens). *Sup. premolars* and *molars* (No. 2379) with somewhat reduced antecrochet and very strong crochet placed near ectoloph; this unites with the ectoloph when well worn and forms a conspicuous medifossette (No. 2388). Crista conspicuous in unworn premolars and molars. Antecrochet somewhat reduced and becoming conspicuous only in old or worn teeth. Molars with cingulum entering median valley between crests, a crest in the bottom of median valley (No. 2388), or embracing protoloph only; with postfossette in m^1; and traces of external cingulum; posterior cingulum of m^3 (also observed in *A. platycephalum* and *A. lemanense*) persisting. Measurements, female, $pm^2 - m^3 = 230$.

The scapulæ and limb bones of large size in the Paris Museum (which are catalogued *R. sansaniensis*) undoubtedly belong to *A. tetradactylum*. Some of these indicate an Aceratherine race as large as or larger than the *A. lemanense* type.

PARIS: This species is also represented in the slightly higher levels of Simorre, especially by a very large jaw of a *female*, with small lower canines, first lower premolar absent, formula: p_3—m_3; of marked dolichocephalic type. LONDON: The jaw from Sansan (Hastings Collection, No. 27454, catalogued *R. goldfussi*) also represents this species; it is large and dolichocephalic in type; the lower canines are flattened with a marked internal flare.

5. UPPER MIOCENE STAGE.

Georgensgemünd.

MUNICH: Upper teeth with closely similar characters (catalogued *A. incisivum*, Georgensgemünd, Bav.) are seen here in a shade *earlier stage* of evolution, because we observe more of a bridge between the premolar crests and somewhat greater prominence of the antecrochet as well as of the internal cingulum of the molars. Another specimen is a characteristic

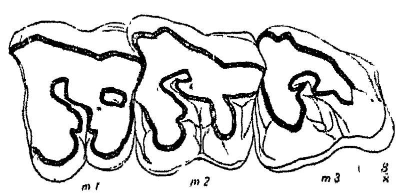

Fig. 9*a*. *Aceratherium tetradactylum*, No. 3378. × ⅜. PARIS.

long and straight lower jaw of this race. (A maxilla, mistakenly catalogued *A. incisivum*, Georgensgemünd, belongs to the Ceratorhine or *C. sansaniensis* race.) VIENNA : A large maxilla, containing pm 1–m 3 (without label) has all the distinctions of the Aceratherine race.

6. Lower Pliocene Stage.

Eppelsheim, Maragha.

Relations of A. incisivum to Elasmotherium.

Aceratherium incisivum *Kaup.*—DARMSTADT : In cranial characters this classic species is less dolichocephalic. In *dental* characters it follows closely upon its predecessors (Fig. 8 *E*) ; in fact, most writers, beginning with Kaup, have not hesitated to unite the *A. tetradactylum* with this animal. The cranial characters, however, are much more progressive, the nasals are shorter and more upturned, the frontals are thickened and bore a rudimentary horn in the males at least. The latter character (Osborn, 99, p. 162) is very significant. One can imagine that this phylum, having failed in the development of horns upon the mechanically weak nasals (as indicated in the Lyons specimen), began to evolve frontal horns. There is no question that the frontals are not only thickened to support a horn (they are very thin in the contemporary *T. brachypus*), but that they show a well marked rugosity with the characteristic converging depressions of nutrient arteries (Fig. 10). It is this character which led the writer to advance the idea that this animal is an ancestor of *Elasmotherium*, an hypothesis which depends upon the future discovery of intermediate forms. It may be observed here, moreover, that *Elasmotherium* has long, narrow, smooth nasals of a type found only in the Aceratheriinæ and that there is theoretically no

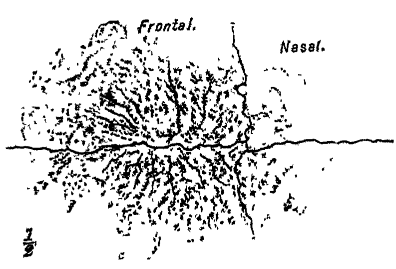

Fig. 10. *Aceratherium incisivum.* Type: DARMSTADT. Rudimentary frontal rugosity, with lines of convergent nutrient arteries.

difficulty in deriving the enormous frontal horn of the Pleistocene species from the vigorous rudiment in *A. incisivum;* or the ptychodont Pleistocene molars from the simple Lower Pliocene stage.

There is a fine skull of *A. incisivum* in HALLE as well as the two in Darmstadt.

7. EASTERN TYPES.

Incertæ Sedis.

The Siwalik Aceratheriinæ have not yet been carefully compared by the writer. *A. perimense* is a very large animal from Perim Island with a skull which, as restored by Lydekker ('81, Pl. X), suggests this phylum, although higher and shorter.

Subfamily BRACHYPODINÆ. PHYLUM III.

Brachycephalic Rhinoceroses, short broad skulls. Teleocerine, horns when developed appear on tips of nasals. Megalodine, large cutting teeth. Brachypodal, short spreading feet, short limbs, body and trunk near the ground. Tridactyl, probable early reduction of lateral digits. Known Geological Distribution, Lower Miocene to Lower Pliocene, inclusive, Europe and America.

These Rhinoceroses, short and broad in all their proportions, including their spreading grinding teeth, represent, so far as we know, the sudden occurrence of a new type in the Lower Miocene of Europe; for they have no known prototypes in the Oligocene of either Europe or America. Either the original home of this type is Africa, and if so, they came into Europe with the Mastodons, or they represent an offshoot of the Aceratheriinæ. Typical species are *T. aurelianensis* Nouel; *T. brachypus* Lartet; *T. goldfussi* Kaup; *T. fossiger* Cope. Doubtful species are *A. persiæ* and *A. blanfordi.* The phylum Brachypodinæ takes its name from one of the oldest known forms, *T. brachypus* Lartet, although it first appears geologically in the *T. aurelianensis* Nouel of the Lower Miocene (Sables de l' Orléanais of France), and includes a great variety of European and American types, extending to the Lower Pliocene, *T. goldfussi* Kaup. The feet in *T. brachypus* and *T. fossiger* become extremely short. Associated with the shortening of the skull is a shortening and broadening of the grinding teeth—the *very broad fourth upper premolar* distinguishes the higher members of this series, notably as developed

in the Lower Pliocene *T. goldfussi* Kaup. In the superior molars the protocone is very prominent and rounded, giving a circular form in extreme wear. The lower and upper cutting teeth attain an enormous size, hence the adjective *megalodine* is appropriate. The shortening of the skull lowers the middle portion of the cranium and in the typical species causes the nasals to project upwards at the tips; thus the irresistible tendency of every Rhinoceros to develop a horn finds expression in the laterally compressed rugosities of the tip of the nasals (*T. aurelianensis*, *T. fossiger*), while an abortive horn may appear on the frontals (*T. aurelianensis*). The strong resemblance of *T. fossiger* to this series was noted by Mme. Pavlow.

The generic name *Teleoceras* Hatcher is the first applied to a member of this series and will be of service to distinguish its members throughout. Valid specific differences are found between the Lower, Middle, and Upper Miocene and Lower Pliocene stages; there are certainly three and possibly four species in Europe.

1. Lower Miocene Stage.

Sables de l'Orléanais.

Teleoceras (R.) aurelianensis *Nouel.*—Type: A skull. Loc. Neuville-aux-Bois, Loiret.

Paris: Characters of type. (1) Three lower premolars in jaw associated with skull; also observed in an isolated better preserved jaw, thus: $p\frac{?}{4-3}$, $m\frac{3}{3}$; flattened outer face of inferior molars is

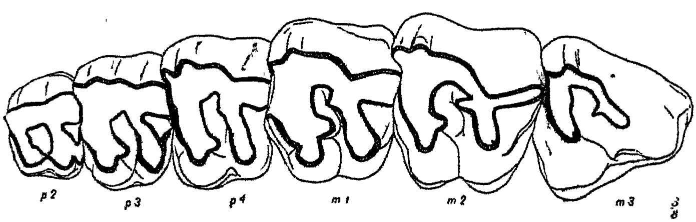

Fig. 11. *Teleoceras aurelianensis.* Type: Superior molars. $\times\frac{3}{8}$. Paris.

another characteristic; superior premolars 3–4 shorter than the molars and provided with antecrochet, as seen also in maxillary series (Collection Vibraye). The strong simultaneous development of antecrochet and crochet distinguishes the molars, as well

as the stout cylindrical protocone. Occiput broad, in a vertical plane; jaw with a decided angle. Front view of nasals is very characteristic (Fig. 12, *D*), a rugosity appears upon each tip with a cleft between (as in *T. fossiger*); there is also a very slight swelling and faint rugosity upon the *frontals* immediately above the eyes which may indicate the rudiment of a median horn. As compared with the Aceratheriinæ the fore and hind limbs and feet in the Paris Museum are relatively short, but they are longer than those of its Upper Miocene relative *T. fossiger* mounted beside them; this species is also distinguished by narrower premolars. (2) A fine lower jaw (Loiret) exhibits premolars with flattened outer wall, also a very small, single-fanged pm_1. (3) The maxillary series (Coll. Vibraye) above alluded to shows a cement layer on the molars as in some Upper Miocene American types.

Lartet in a letter to Nouel expressed the opinion that this species was identical with the Middle Miocene *T. brachypus*. A close comparison of the teeth of these two species in the Paris Museum reveals the following resemblances and differences:

T. aurelianensis.	*T. brachypus.*
Premolars broad	Premolars broad
Antecrochet strong in p 3, p 4	Antecrochet reduced or wanting
Metaloph of p^4 long	Metaloph of p^4 long
Molars, internal cingulum wanting	Cingulum strong

2. Middle Miocene Stage.

Simorre, Sansan (?).

T. brachypus *Lartet.*—Paris: A fine maxillary series from Simorre, Gers (Coll. Lartet No. 2386); fourth superior premolar (p^4) compressed anteroposteriorly and extending transversely more than in *T. aurelianensis;* superior molars with strong internal cingula; inferior molars with extremely flattened outer faces; enormous upper incisors. This species is generally said not to occur at Sansan, but a single lower canine tooth (catalogued *R. tetradactylum*, Paris Museum) probably represents it on this level.

3. Upper Miocene Stage.

Grive-St.-Alban, Steinheim.

T. brachypus.—The finest examples of this species are found in the Muséum d'Histoire Naturelle of Lyons and have been described and figured by Depéret. Relying upon his determination ('87, p. 178) we observe the following dental characters:

Superior premolar 1 simple; premolars 3–4 without antecrochet (thus differing from *T. aurelianensis*); premolars 2–3 with small crista and crochet; premolar 4 with crista and forked crochet; molar 1 with small crista, strong crochet, antecrochet reduced (as compared with *R. aurelianensis*); molars 1–3 with internal cingulum extending around inner face. *Inferior* premolars with flattened outer faces. Measurements, Mts. III = 110.

Depéret observes that the true *T. brachypus* always has an internal cingulum upon the upper molars. I do not, however, feel convinced that this specific determination is correct.

HALLE: A distinct variety of this type occurs at Steinheim, and was shown to me in this fine collection through the kindness of Professor Fritsch; it is distinguished by very thick enamel, square posterior fold of ectoloph (due to the antero-posterior compression of the dentition correlated with the brachycephalic skull), crista, crochet, and antecrochet all showing in well worn superior molars; cingulum only around protoloph of molars (in typical *T. brachypus* it embraces metaloph also). This variety may become known as a distinct species, *T. eurydactylus*, for there certainly are some minor differences between this and the typical *T. brachypus*.

MUNICH: The foot bones of manus and pes, Mtc. III = 145, Mts. III = 110, astragalus = 50 (types of *R. eurydactylus* Haushalter), are almost identical in size and proportions with those of our Upper Miocene species, *T. fossiger* Cope, of America. A lower jaw (Steinheim) exhibits the following characters: symphysis, short; diastema very short, first lower premolar vestigial, single-fanged, close to canine; second lower premolar comparatively simple, reduced, single-lobed. There is also a fragmentary skull from the Dinotherium Sands near Günzburg with occiput low and broad as in *T. fossiger*. Also from Steinheim a large collection of isolated upper molars, with the following characters: superior fourth premolar broader than first molar (as in *T. goldfussi*); superior first molar with very thick enamel, a crista, large antecrochet, and broad internal cingulum extending around protoloph only. The Steinheim teeth of Munich therefore agree closely with those in the Halle collection and indicate that the northern (? *T. eurydactylus*) variety differed in a definite particular from the southern typical *T. brachypus* race, namely: *cingulum extends around protoloph only*; this character (cingulum around

protoloph only) is also observed in a cast of four molar teeth (Mantscha bei Graz) in the Munich collection, but it is not seen in the Augsburg skull.

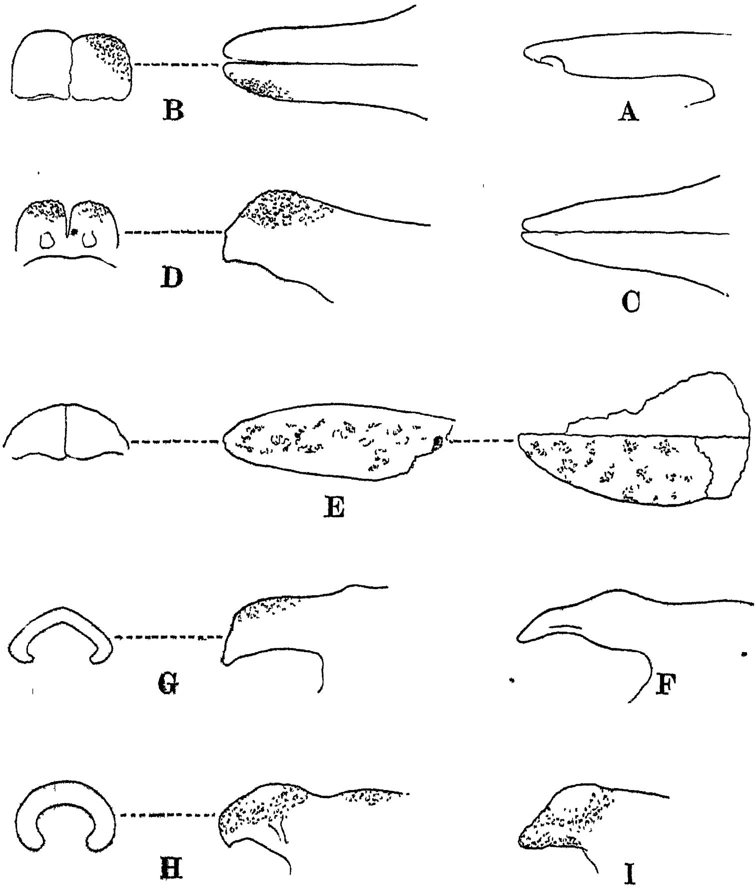

Fig. 12. Characteristic types of nasals and nasal rugosities. A, *Aceratherium tetradactylum*, PARIS. B, *A. lemanense*, LYONS (Pyremont). C, *A. incisivum*, HALLE. D, *Teleoceras aurelianensis*, PARIS. E, *Incertæ Sedis*, AUGSBURG. F, *Rhinoceros sansaniensis* (restored). G, *R. platyrhinus*. H, *Atelodus bicornis*. I, *A. simus*. Mostly after rough sketches by the author.

AUGSBURG: Other characters of this variety are given by the fine specimens in this museum shown to the writer through the kindness of Dr. Otto Roger, also communicated by letter (May 30, 1899), but especially in his very full and valuable paper

(Roger, '00), received just as this paper was going to press. Locality: base of lower Dinotherium Sands, near Augsburg. Very aged skull (Roger, '00), found at base of sands, short and massive; premolars and molars with strong cingulum surrounding three sides of the crown; p^1–m^3 = 260. Measurements:

	p. 1	2	3	4	m. 1	2	3
Length	27	29	35	37	40	49	58
Breadth	18	35	48	57	56	56	53

Breadth greatly exceeding length throughout upper grinders; superior diastema i–p = 85; zygomatic arches strong; occiput as broad above as below; supra-temporal crests separated by a median groove; in mid-frontal region bones as thin as paper (an important distinction from *A. incisivum*); nasals a single, compact, laterally compressed bone without trace of median cleft or suture (thus differing from *T. aurelianensis*), thickened at the extremity but not laterally compressed as in *T. aurelianensis* and *T. fossiger*; meatus auditorius open below (resembling *R. sumatrensis*). I am inclined to regard this as a female skull and to believe that a male would show rugose nasal tips; in fact, nasals with rugose tips were described and figured by Roger ('85) (Fig. 12, *E*). This animal shows decided specific differences, but an unmistakable racial resemblance to both *T. aurelianensis* and *T. fossiger*. Other characters of this species observed in Augsburg specimens are, *lower jaw*: short symphysis; very short diastema (10); small coronoid process bending sharply forward; small incisors; first lower premolars always wanting; outer face of lower grinders flattened; total premolar series = 111.5, molar series = 165; dental formula, $\frac{1}{1}$ $\frac{0}{1}$ $\frac{4}{3}$ $\frac{3}{3}$; grinding teeth large in proportion to skull.

STUTTGART: Teeth measurements: Pm^4, breadth, 60, length, 40. Limb measurements: Steinheim collection (Roger, '00, pp. 16–17), humerus, length, 350 to 420; radius, 290 to 370; femur 390 to 540; tibia, 290 to 340; metatarsals, I = 108, III = 112, IV = 96; these measurements indicate that the limbs are somewhat longer than those of *T. fossiger* (*cf.* Osborn, '98, p. 57). The pointed vestigial first lower premolar is preserved in one jaw; lower incisors small and sharply pointed. A maxillary series (Steinheim, No. 6314) is referred by Roger ('00, p. 14) to this species, mistakenly, I believe, because the

long narrow measurements of the grinding teeth indicate that they belong to a dolichocephalic type, probably *A. tetradactylum.*

A jaw recently excavated by Professor Fraas himself (Steinheim) exhibits small pointed incisors and a vestigial pointed pm_1.

Lower Pliocene Stage.

Eppelsheim.

T. goldfussi *Kaup.*—The foregoing studies enable us to determine that the tooth which Kaup selected from the sands of Eppelsheim for the *type* of this species is not a molar, as he supposed, but a *fourth superior premolar ;* this tooth has a broad internal cingulum ('Ossements Fossiles,' Darmstadt ; in 'Akten d. Urwelt,' 1841, he adds as *cotypes*, a lower molar, and upper incisor ; in 'Beitr. z. Näher. Kennt.' he figures an upper molar, Taf. II, fig. 20 ; a lower molar, fig. 15). In the same Eppelsheim sands are found other teeth with characteristic peculiarities of this brachycephalic-megalodine phylum, viz. : greatly enlarged upper incisors, upper molars with crochet and antecrochet projecting into median valley, lower molars with flattened outer wall.

T. goldfussi is very imperfectly known ; it cannot now be distinguished specifically from *T. brachypus*, except by its larger size. So far as we know it was the last member of the subfamily Brachypodinæ.

Types. Incertæ Sedis.

The Siwalik Rhinoceroses have not yet been carefully examined by the writer. The *Aceratherium blanfordi* Lydekker, type, resembles the Brachypodinæ in the structure of its superior molars. From the Lower Pliocene or Maragha is another remarkable interesting form, *A. persiæ* Pohlig, which appears to be distinct from *A. blanfordi.*

Aceratherium persiæ *Pohlig.*—This species is richly represented in Vienna (Collection Polak) by ten more or less complete skulls ; there is also a fine skull in the Halle Museum. Characters : Last superior molar quadrate with an exceptional extension of ectoloph, and a vestige of posterior valley ; ectoloph of molars in a nearly straight line ; antecrochets and crochets of molars very prominent, giving a complex pattern upon extreme wear ;

enamel thin; protocone large, strongly constricted off. These dental characters approach those of *Teleoceras fossiger*.

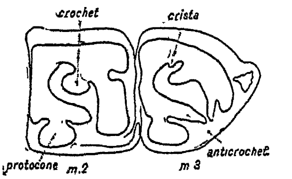

Fig. 12*a*. *Aceratherium persiæ*. Second and third superior molars. HALLE.

In some of its cranial characters it approaches *A. incisivum*, except in the extraordinarily broad chin which is hollowed out in the median line (see also lower jaws referred to *A. blanfordi* in British Museum); thus the lower canines diverge and are set widely apart, with the persistent alveoli of lower incisors between; nasals short, straight and smooth; a sagittal crest; occiput higher than broad; zygomatic arch slender. A strong rugosity upon the molars beneath the eyes for the origin of the masseter muscles, which are inserted in a strong ridge on the outer border of the angle of the jaw. Tibia and fibula closely united (as in Brachypodinæ). Limbs of medium length.

Subfamily CERATORHINÆ. PHYLUM IV.

Middle Miocene to recent Rhinoceroses; dolichocephalic, with frontal horns, and nasal horns upon a distinct mid-nasal convexity, not terminal; nasals more or less pointed and recurved anteriorly; cutting teeth large in early members, gradually reduced in certain branch phyla; cursorial limbs.

The first known of this series, *R. sansaniensis* of the Middle Miocene, appears to represent *a new arrival and a new phylum in Europe;* it certainly has no ancestors among the previously known Diceratheriinæ, Brachypodinæ, or Aceratheriinæ, for the structure of the entire upper portion of the skull is different; it is barely possible that some of the teeth referred to *A. minutum* from the Upper Oligocene may represent its ancestors; but this is not probable. Its successors or collateral descendants, however, are probably determined as the *R. simorrensis* of Simorre, the *R. steinheimensis* of the Upper Miocene of Steinheim and Grive-St.-Alban; these animals apparently gave off: (*A*) a *smaller race*, the last of which appears in the Lower Pliocene, Eppelsheim; in Eppelsheim and Pikermi, however, there also appears (*B*) the *larger race* of *R. schleiermacheri* possessing many of the same characters as *R. sansaniensis*, but with certain notable distinctions.

The generic name *Rhinoceros* may be retained at present for members of this series, but in case a relationship to the Sumatran

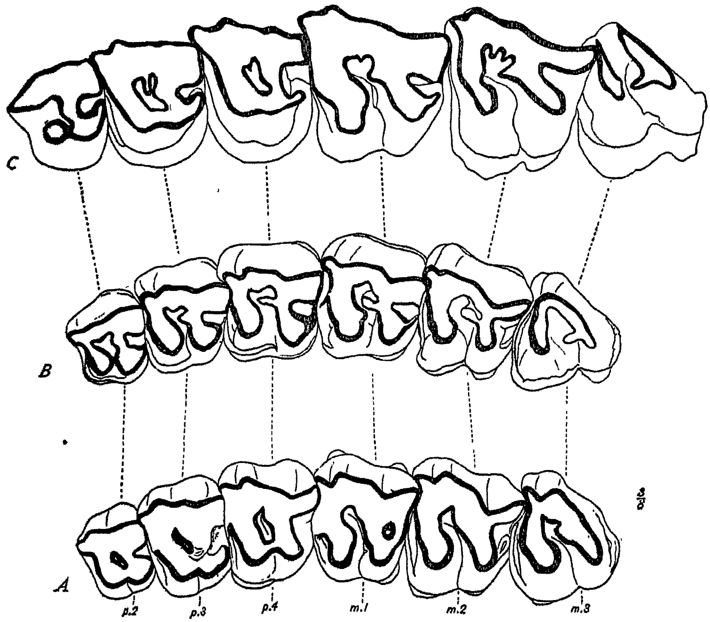

Fig. 13. Superior molar series. *A*, *R. sansaniensis.* Type: PARIS. *B*, *R. simorrensis*, No. 2380. PARIS. *C*, *R. schleiermacheri.* STUTTGART, after Kaup. All × ⅗.

Rhinoceros should subsequently be demonstrated, it would be well to apply Gray's term *Ceratorhinus* throughout.

A. Smaller Race. Middle Miocene to Lower Pliocene.

1. MIDDLE MIOCENE STAGE.

Dental Characters.—Large lower canines (males) ir Miocene; first lower premolars relatively persistent (unlike Diceratheriinæ), r tained to Middle Miocene, then reduced; upper premolar transformation retarded, crests confluent upon wear in *R. sansaniensis*, free in *R. simorrensis*; upper molars and premolars with internal cingula reduced or absent; molar-premolar series of moderate length ($pm^2 - m^3 = 190$ in *R. sansaniensis*), much shorter than in the contemporary Aceratheriinæ, proportionately longer and narrower than in the Brachypodinæ; molars retaining a feeble antecrochet.

Cranial characters.—Nasals short and broad, triangular when seen from above; median horn precociously (Middle Miocene) developed upon both nasals and frontals; occiput both broad and high (very distinct from Aceratherine, Diceratherine, or Brachypodine types).

a. Lower Level, Sansan.

R. sansaniensis.—Paris: The type skull (No. 2395, Coll. Lartet, Sansan) is that of a *male*, a small animal; it is very much crushed antero-posteriorly, disguising its real *dolichocephalic* character, which is strongly marked in the uncrushed lower jaw; the first lower premolar has a broad double or grooved fang, while in *R. simorrensis* this tooth is small and single-fanged; the premolars are greatly worn so that the median valley has almost disappeared

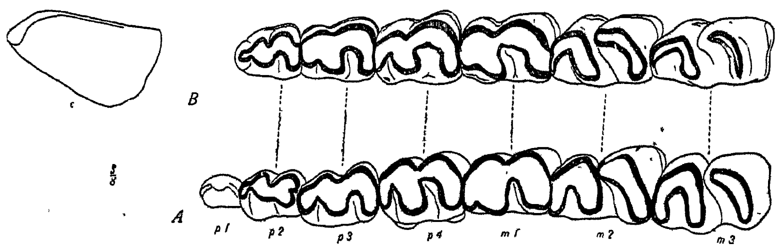

Fig. 14. Lower grinding series. *A*, *R. sansaniensis.* Paris. *B*, *R. simorrensis.* Paris.

and the crests are quite confluent: although a male (because of its well developed horns) the inferior canines are smaller than in the *R. simorrensis* jaw; the simple character of the molar crests in this specimen is deceptive, and is due to extreme wear, the crochet (a superficial fold) having been worn off, the protocone and antecrochet are indistinctly marked (quite unlike the Aceratheriinæ and Brachypodinæ of this geological period); the inner face of the molars is without cingulum (unlike Aceratheriinæ and Brachypodinæ); there are indications that young teeth would show both crista and crochet; the nasals and occiput have a very characteristic shape, somewhat similar to that of Gaudry's *R. schleiermacheri* of Pikermi; the nasals are especially distinctive, being broad and rugose behind, where they carry the horn, but converge to a smooth point anteriorly; (See Paris, Nos. 2395, 551); metatarsals (erroneously catalogued *A. tetradactylum*), of moderate length, probably belong to this species.

b. Higher Level, Simorre.

R. simorrensis *Lartet.*—PARIS: (1) In this animal from a higher level (100 metres) we observe distinct specific progression: the size is the same; the lower canine is larger; the first lower premolar is single-fanged, reduced or wanting; the crests of the upper molars (Lartet Collection: No. 2380, catalogued as *A. tetradactylum*) are more distinct; the younger molars have a feebly indicated antecrochet and a very strong crochet; upon extreme wear the antecrochet comes out more strongly. (2) A handsome lower jaw shows the vestigial pm_1 persisting on the left side, wanting on the right (Fig. 14); the lower grinders are small, fine, and delicately built; the diastema is rather short. (3) A maxillary series (Coll. Lartet, No. 2380) is beautifully preserved; the fourth superior premolar is fully molariform, with a prominent antecrochet; the superior molars show a reduced antecrochet and a very prominent crochet. Measurements: $pm^1 - m^3 = 193$ (Coll. Lartet, No. 2380); $pm_2 - m_3 = 195$.

LYONS: Two fine maxillæ of *R. simorrensis* are found in the Muséum d'Histoire Naturelle and present characters exactly similar to the above; strong postfossettes are observed in $pm^2 - m^1$ and strong and prominent crochets on $pm^3 - m^3$; the molars have the internal cingula feeble or wanting. LONDON: Upper jaws and teeth (No. 33525, Villefranche, d'Astarac, Gers, France) a beautifully preserved apparently *female* skull with no trace of median horns on frontals; molar teeth with the same characters, $p^1 - m^3 = 193$. A lower jaw (No. 33526, same locality) exhibits a single-fanged and evidently much reduced first premolar. The *R. austriacum* Peters is represented in Munich by the third superior molar tooth. The type of this species from Eibiswald-Leiding is doubtfully distinct from the foregoing.

2. UPPER MIOCENE STAGE.

Steinheim, Grive-St.-Alban.

The Upper Miocene stage of this small race is the so-called *R. steinheimensis* Jäger, from Steinheim. (1) The finest example of this stage is a maxilla in STUTTGART (Steinheim, No. 6032);

pm^1 is quite simple ; pm^2 shows a crista and small antecrochet ; pm^3 shows a prominent crochet ; pms $^{3-4}$ differ from molars in the absence of antecrochet fold ; the molars show a crista, reduced antecrochet, and very prominent crochet. (2) Another maxilla (No. 4230) shows a larger size, $pm^1 - m^3 = 200$. LYONS: similar teeth are found from Grive-St.-Alban. It is probable that this stage represents a distinct species, in which case it should be termed *R. steinheimensis* Jäger ; at present, however, we know no means of distinguishing it from *R. simorrensis*. MUNICH : A fine example of maxillary series from Georgensgemünd (catalogued *A. incisivum*) exhibits premolars and molars without internal cingulum ; the premolars have complete internal crests.

Conclusions.—There is a gradual advance in size (molars from 190 to 200) and in the evolution of the premolars, as we pass from the Middle to the Upper Miocene Ceratorhinæ.

3. LOWER PLIOCENE STAGE. LAST OF SMALLER RACE.

Eppelsheim.

R. steinheimensis.—Kaup referred the smaller teeth of Eppelsheim to *A. minutum* Cuvier ; this was an error. One of these Eppelsheim teeth, a third superior molar, is in LONDON (British Museum, No. 1257) ; it agrees closely in every particular with those of *R. simorrensis* both in size and character ; it is a much worn tooth and shows a large antecrochet. Casts of the Eppelsheim molars (M. 2739, 2740, 2742) are also identical with those of *R. simorrensis*. DARMSTADT : An examination of Kaup's originals in this Museum confirms the above determination (see Kaup, '62, Taf. II, figs. 6, 10, 11, 13). There is little doubt, therefore, that this smaller race of Ceratorhinæ persisted in the Lower Pliocene ; the specific characters of this stage are undetermined.

Fig. 15. *R. steinheimensis.* Last superior molar. Steinheim, MUNICH.

B. Larger Race.

4. LOWER PLIOCENE STAGE.

Eppelsheim, Pikermi.

We can imagine that the *smaller race* arrived in Europe (either from Asia or Africa), was arrested in size development and

terminated in the smaller Eppelsheim species; then from the same original stock, by subsequent migration, a collateral *larger race* arrived, which in general had developed along the same lines, but had retained certain primitive characters.

Such a collateral species is Kaup's *R. schleiermacheri* of Eppelsheim (Fig. 13, *C*). It exhibits molar-premolar teeth measuring 260; it is thus nearly one-third larger than *R. steinheimensis;* it resembles the *R. sansaniensis* series in the following points: superior molars: antecrochets reduced; a crista (progressively bifid); a prominent crochet; skeleton: metapodials of medium length; tridactyl manus. It differs as follows: premolars with crests internally confluent upon wear (primitive); first lower premolar persistent (primitive); a sagittal crest (primitive); small cutting teeth (progressive); very large nasal and frontal horns (progressive); no postfossettes in the molars; wide distance between orbit and naso-maxillary notch (this space is somewhat shorter in *R. sansaniensis*, indicating a progressive lengthening of the skull in *R. schleiermacheri*).

Therefore, as placed together in the Paris Museum the Middle Miocene *R. sansaniensis* and the Lower Pliocene (Pikermi) *R. schleiermacheri* exhibit first a striking racial similarity in form; second, a difference in size exactly such as one would expect in the progression from a Middle Miocene to a Lower Pliocene type; third, certain primitive and progressive differences which render the theory of direct descent of one from the other impossible. If one compares the skulls closely one sees the striking racial likeness in the form, and especially in the proportions and positions of the horns upon the nasals; the occiput of *R. schleiermacheri* is relatively lower and is somewhat broader below. In both specimens the infraorbital foramen is very close to the naso-maxillary notch; thus it is evident that these species, although not genetically related, represent collateral branches of a similar race. The growth of the skull between the orbit and anterior nares points to progressive dolichocephaly and to correlated elongation of the limbs and feet.

The successors and relatives of this Ceratorhine phylum are, apparently, *R. leptorhinus* Cuvier, Middle Pliocene, represented by a fine skull (Paris Museum, Montpellier, Hérault); the long-limbed *R. etruscus* from the Upper Pliocene of Italy, France, and

England, with a nasal septum; *R. platyrhinus* of the Pliocene Siwaliks of India (which Lydekker has mistakenly associated with the Atelodinæ); finally, the smaller and somewhat primitive living species, *R. sumatrensis*.

Subfamily ATELODINÆ. PHYLUM V.

Lower Pliocene to recent Rhinoceroses. Dolichocephalic, long low skulls, moderately broad, depressed, backwardly inclined occiput; two large horns developed upon nasals and frontals; nasals square or blunted anteriorly, horns extending to the extremities; Atelodine, cutting teeth vestigial or wanting; mesopodal, moderately long limbs and digits, similar to those of R. indicus.

1. Lower Pliocene Stage.

Pikermi, Maragha.

In the Lower Pliocene of Pikermi there suddenly appears in Europe a fifth type which cannot be derived from any of the preceding; the cutting teeth are precociously vestigial or wanting (hence the term Atelodinæ); the skull is easily distinguished by the form of the temporal fossa and occiput, by the form of the nasals and by the absence of front teeth in the dolichocephalic megalodine *R. schleiermacheri*, which appears in the same beds. The species is not found in the more northern Eppelsheim beds, and in view of the many resemblances which the Pikermi type, *R. pachygnathus*, bears to the existing African species (*R. simus*, *R. bicornis*), we may not consider as unreasonable the hypothesis that this is an African phylum which entered southern Europe with the numerous Antelopes and Giraffes of Pikermi; the later members of this phylum are the Pleistocene *R. hemitœchus* and *R. antiquitatis* (= *tichorhinus*), and the recent *R. simus* and *R. bicornis*. The main characters of this phylum are given above.

R. pachygnathus *Wagner*.—Paris: A fine skull and skeleton of this type have been described and figured by Gaudry. Even in the young skull there is a decided thickening for a frontal horn; the nasals are very broad and thick at the extremities; the lower jaw is without distinct angle, and a single convex sweep from condyle to angle is very characteristic; correlated with this we observe a weak zygomatic arch and early reduced front teeth; the most distinctive feature is the backward sweep of the temporal fossa, the low, backwardly inclined occiput. The molars are *brachyodont*. In the older jaw the formula is: $i_{\frac{0}{0}} c_{\frac{0}{0}} p_{\frac{2}{2}} m_{\frac{3}{3}}$.

Duvernoy actually attributed *R. pachygnathus* to the Pleistocene species *R. antiquitatis*, from resemblances in the limb bones, and Gaudry remarks ('62, p. 177) that this was very natural because the bones are extremely similar. Again, as originally remarked by Gaudry, *R. pachygnathus* resembles *R. bicornis* (the smaller brachyodont shrub-eating species of Africa), and ('62, p. 178) closely also *R. simus* (Burchell's Rhinoceros, the larger hypsodont, grass-eating species of Africa); I have verified these remarks by very careful studies of specimens in Paris and London. *R. simus* has a square upper lip, with broadly truncate upper nasals, the horn rugosities being carried to the very extremity, and its cranial resemblance to *R. pachygnathus* is remarkable. *R. bicornis* has, on the contrary, a pointed prehensile upper lip, and its somewhat more pointed nasals may be correlated with this narrower snout, but the horns are carried to the very extremity (at which there is sometimes a slight cleft, British Museum specimen).

Atelodus neumayri, sp. nov.[1]

Type, a large male skull, Vienna Museum, from Pikermi or Maragha (Persia), (erroneously catalogued as *R. schleiermacheri*). This skull resembles *R. pachygnathus* as follows: large frontal and nasal horn cores; auditory meatus closed; zygomatic arch slender (correlated with reduction of angle and masseteric muscles); lower border of jaw convex; dentition: $\frac{?}{?}, \frac{?}{?}, \frac{3}{3}, \frac{3}{3}$. It differs from *R. pachygnathus* as follows: molars elongate, tending to hypsodontism; cement covering sides of molar crowns; the pattern of the premolar and molar teeth unique and without precedent; there is no true antecrochet on the protoloph, but a fold, which might be considered as an aberrant crista, projects into the median valley from its outer portion, that is, *external* to the crochet (whereas the antecrochet always appears *internal* to the crochet); the prominent crochet is placed internally to this; strong hypostyle fold and postfossette on p^3 to m^1.

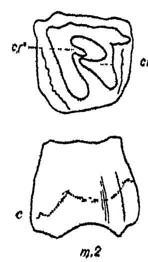

Fig. 16. *Atelodus neumayri.* Type: Second superior molar. VIENNA.

An apparently similar fold is observed in *R. antiquitatis*, and connects the protoloph diagonally with the metaloph; *A. neumayri* therefore resembles *R. antiquitatis* more closely than *R. pachygnathus*, both in the presence of this fold and in the greater hypsodontism of its molar teeth.

[1] Dedicated to the late distinguished Austrian geologist, Melchior Neumayr.

2. Pleistocene and Recent Stages.

An adaptive parallel to these types is presented in the Middle and Upper Pleistocene species: *R. antiquitatis* resembles *R. simus* (and less closely *R. neumayri*) with broadly truncate nasals, slender zygoma, and hypsodont, small, very narrow molar teeth; while *R. hemitœchus*[1] resembles *R. pachygnathus* and *R. bicornis*, with brachyodont molar teeth. In both *R. hemitœchus* and *R. bicornis* the nasals are somewhat narrower and the upper lips more prehensile and pointed. These large Pleistocene animals (which co-existed for a while) thus differed in details of dentition in adaptation to local differences of feeding ranges and habits, but resembled each other in (1) extreme dolichocephaly, (2) backward inclination of the occiput, (3) powerful nasal septum, (4) horns on extremities of nasals.

The existing African species, *R. simus* and *R. bicornis*, like *R. sumatrensis*, in the Ceratorhine series, are, however, both less specialized than the Pleistocene types.

Subfamily RHINOCEROTINÆ. PHYLUM VI.

Brachycephalic or intermediate between extreme dolichocephalic and brachycephalic types; occiput inclined forwards. Single horns upon mid-nasals; nasals pointed and generally smooth at the extremities. Megalodine, large upper and lower cutting teeth.

No representatives of this phylum have been found in Europe. In Asia, however, the Pliocene Siwaliks yield species which are probably ancestral to the typical *Rhinoceros unicornis* of India. Lydekker ('81, Pl. X) shows that *R. palæindicus* leads into the hypsodont or grass-eating *R. unicornis* type, while *R. sivalensis* leads into the brachyodont or shrub-eating *R. sondaicus* type. All these four species exhibit a skull with forwardly inclined occiput, concave and hornless in the frontal region, nasals with a large horn in the middle portion which does not extend to the smooth and pointed extremities; well developed cutting teeth.

The origin and relationships of this phylum are unknown; it will be noted that it is exclusively south Asiatic in distribution and this (Oriental Region) may ultimately prove to be its home and exclusive centre of adaptive radiation.

[1] See Geol. Mag. (2), Vol. I, Pl. XV, as figured by Davis.

FAMILY RHINOCEROTIDÆ. THEORETICAL SUCCESSION OF PHYLA I–VI IN EUROPE.

	Subfamily: I. Diceratheriinæ.	II. Aceratheriinæ.	III. Brachypodinæ.	IV. Ceratorhinæ.	V. Atelodinæ.	VI. Rhinocerotinæ.
	Recent	....	....	Ceratorhinus sumatrensis	Atelodus bicornis " simus.	Rhinoceros indicus. " sondaicus.
Pleistoc.	Upper	[1] Elasmotherium sibericum	....	....	" antiquitatis	" sivalensis. " palæindicus.
	Middle	....	....	....	" merckii	....
	Lower	....	....	....	....	....
Pliocene.	Upper	....	....	C. etruscus .... C. platyrhinus	....	....
	Middle	....	....	C. leptorhinus	....	....
	Lower	Aceratherium incisivum	Teleoceras goldfussi	C. schleiermacheri. [1] C. steinheimensis.	" neumayri " pachygnathus	....
Miocene.	Upper	A. tetradactylum.	T. brachypus	C. steinheimensis....	....	....
	Middle	A. tetradactylum.	....	C. simorrensis.... C. sansaniensis....	....	....
	Lower ? Diceratherium douvillei....	A. platyodon....	T. aurelianensis.	....	....	....
Oligocene.	Upper " minutum....	A. lemanense....	....	....	....	....
	Middle	....	....	....	....	....
	Lower [1] Ronzotherium velaunum [1] " gaudryi..	A. filholi.......	....	....	....	....
	Geographical Districts: Europe, America.	Europe, Asia, America.	Europe, America.	Europe, Asia.	Europe, Africa.	Asia.

[1] Incertæ Sedis.

CONCLUSIONS.

This phylogeny leaves many species untouched and unsettled. It certainly contains both errors and omissions, and I set it forward mainly as a *method of solution of the Rhinoceros problem.*

1. It disregards homoplastic or convergent characters, which are often entirely misleading.
2. Great stress is laid upon exactness as to stratigraphical or geological succession, the neglect of which has been a fertile source of error.
3. According to our present knowledge, none of the six phyla can be connected by European stem forms, as in the phylogenies previously attempted.
4. The newer hypothesis of foreign (African or Asiatic) invasion into Europe of certain phyla has at present more in its favor than the older hypothesis of the derivation of all Upper Tertiary from Lower Tertiary types of Europe.
5. It is a fact that the earliest known members of each phylum show substantially all its fundamental characters; subsequent modifications are adaptive and may be more or less convergent to other phyla.
6. Generic, specific, and subfamily terms are simply our symbols for clear thinking and description. If the hypothesis of six or more distinct phyla is correct, and these breeds or races have been distinct since the Middle, and in some cases since the Early Tertiary Period, then the actual remote relationships of the individual members of said phyla will be most truthfully and clearly expressed both by the revival of certain disused generic names, and by the use of subfamily names.

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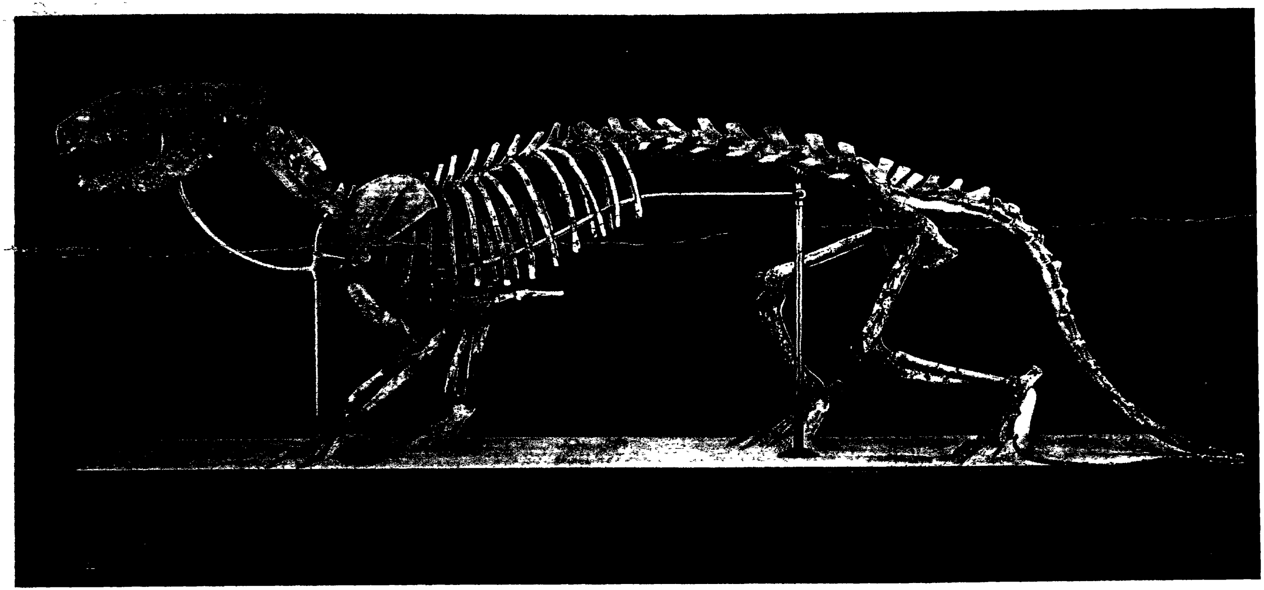
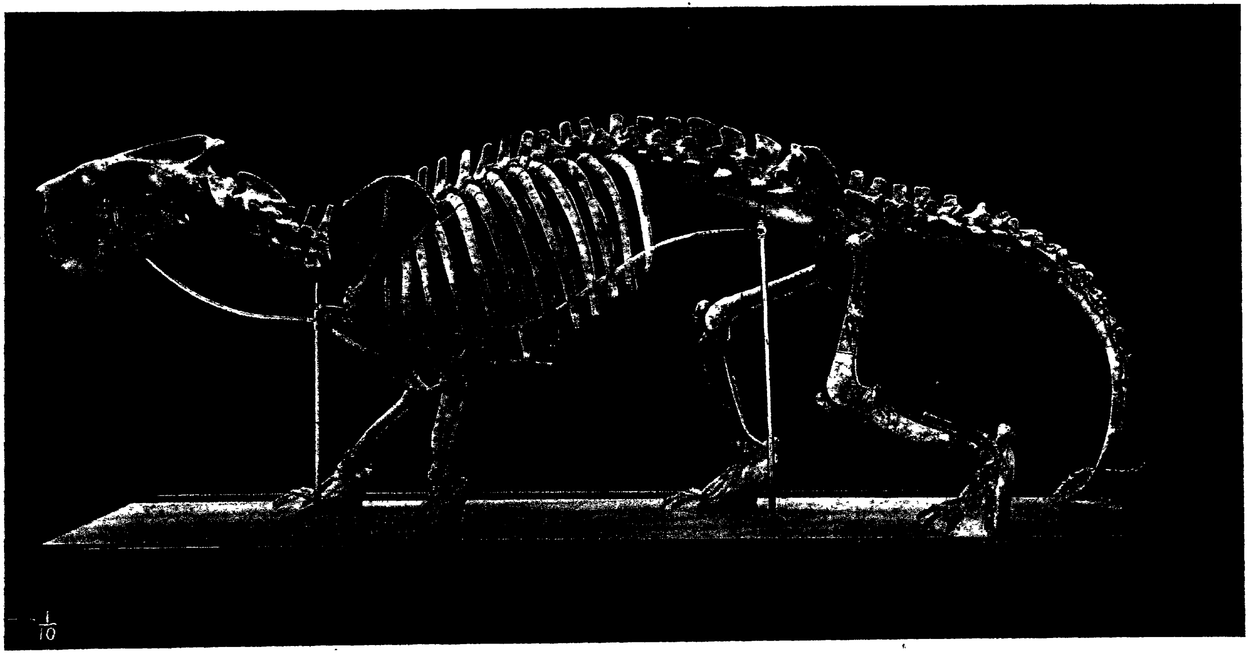


Oxyæna lupina, Mounted Skeleton in the American Museum. One Individual.



Patriofelis ferox, Remounted Skeleton in the American Museum. Including Parts of Two Individuals.

Article XX.—OXYÆNA AND PATRIOFELIS RESTUDIED AS TERRESTRIAL CREODONTS.

By Henry Fairfield Osborn.

Plates XVIII and XIX.

Comparatively little was known of the skeletal structure of these animals until the American Museum Expeditions of 1891 and 1893 secured complete skeletons of each, which Dr. J. L. Wortman carefully described and figured. After a searching comparison with modern land and water Carnivora he concluded that *Patriofelis* was probably *aquatic in habit and possibly ancestral to the modern Pinnipedia* and that the much older type *Oxyæna* and the more recent type *Oxyænodon*, bore similar testimony to affinities with the Seals. In describing *Patriofelis* he remarked: "The broad, flat, plantigrade feet with their spreading toes suggest at the first glance their use for swimming" ('94, p. 161).

Fig. 1. *Didelphys virginiana*, left fore foot.

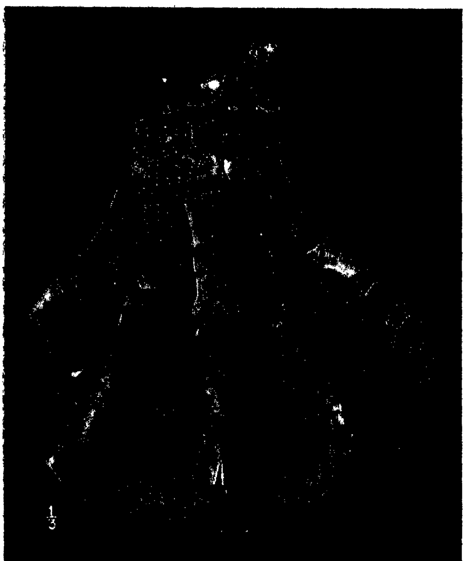


Fig. 2. *Patriofelis ferox*, left fore foot, from mounted skeleton.

Recently, under the direction of the present writer, the *Oxyæna lupina* skeleton has been mounted and the *Patriofelis ferox* skeleton taken apart and remounted by Mr. Hermann, head preparator. At the same time several

alterations were made in the restored parts of the skull of *Patriofelis*, the teeth were restored, one dorsal vertebra added, and, for reasons stated below, the feet reset in an angulate subdigitigrade instead of a plane plantigrade fashion. A more thorough study of the dentition of this animal was also made from all the materials in the Museum.

In this connection a careful restudy of all the evidence led the writer to the opposite conclusion, that these were powerful *terrestrial, or partly arboreal, animals, analogous to the Cats in habits of feeding*, with analogous (not homologous) sectorials, clumsy in limb structure, without prehensile claws, and presenting no evidence of successors among the modern Carnivora. The reasoning upon which this conclusion is based is, in brief, that the alleged points of resemblance to the Pinnipedia are in part persistent primitive characters due to the descent of the Oxyænidæ and Pinnipedia from a common Insectivore-Creodont ancestor, in part homoplastic adaptive characters due to similar habits or uses of certain parts of the body, while the main trend of adaptation is divergent from the Pinnipedia as seen both in the teeth and feet, and from all other modern Carnivora, especially as seen in the teeth.

In this paper the principal osteological and dental characters will be briefly restated with a number of corrections and additions, referring the reader back to Wortman's fuller papers for details.

I. Evidence for Terrestrial Habits.

1. *The Feet.*

It was claimed (Wortman, '94, p. 161) that the plantigrade feet with spreading toes indicated a webbed ('94, p. 146) or swimming foot. It will be observed by comparison of the photographs (Figs. 1, 2) that the feet of *Patriofelis* are no more widely spread than those of the terrestrial and arboreal *Didelphys*. Moreover, the planes of the articular facets of the metapodials and phalanges in *Patriofelis* entirely forbid the supposition that this animal was plantigrade.

The writer has pointed out ('00, p. 91) that the angulation of the limbs in Ungulates is expressed in the angles which the prox-

imal and distal facets make with the long axes of the shafts; *considering the shafts as perpendicular, facets in horizontal planes indicate straight limbs; facets in oblique planes indicate angulate limbs.* Exactly similar principles apply to the hand and foot of Unguiculates, as shown in Fig. 3. In the passage from *Otaria*

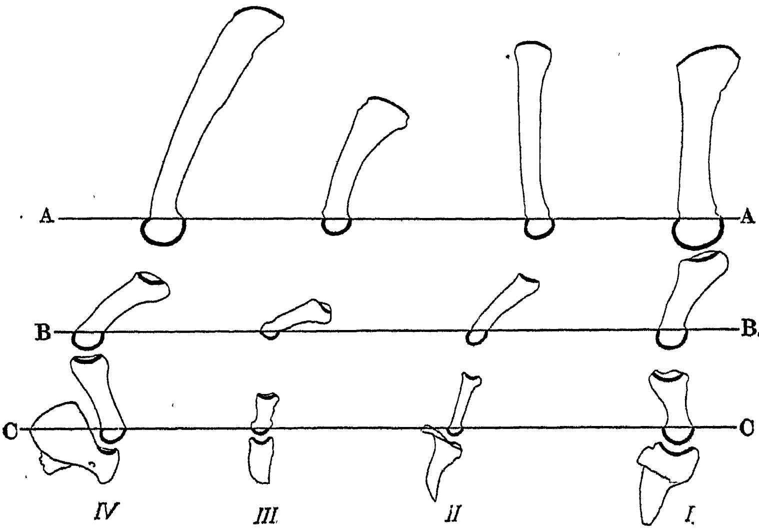


Fig. 3. Angulation of facets in feet of (I) *Ursus*, (II) *Procyon*, (III) *Patriofelis*, (IV) *Felis*, showing increased obliquity in relation to increased angulation.
A, distal facets of metacarpals; B, distal facets of 1st phalanx; C, distal facets of 2d phalanx.

(secondarily plantigrade), *Ursus* (primarily-plantigrade), *Procyon* (subdigitigrade), and *Felis* (digitigrade), we see that the planes of the distal facets give certain indication of the modes of progression.

1. As regards angulation, *Patriofelis* is shown to occupy a position intermediate between *Procyon* and *Felis*, with a decidedly *angulate* foot, the angles between phalanges 1 and 2 being especially acute. This proves that the metapodials, as well as phalanges 1 and 2, were raised off the ground by palmar and plantar pads as in *Felis*. Taking a conservative view, the feet of *Patriofelis* may be described as subdigitigrade in position. The straight terminal claws indicate that they entirely lacked the grasping and tearing power developed in *Felis*.

2. As observed by the writer and Wortman in *Oxyæna* ('99, p. 144): "There is reason to believe that the habitual position of the foot was digitigrade, but there is no evidence of any retractility of the claws." Beginning therefore with a subdigitigrade foot, the progression from *Oxyæna* to *Patriofelis* does not indicate an advance toward secondary plantigradism, as would be the case if these animals were becoming more and more aquatic in habit. On the contrary, the analogy of the feet of the known Oxyænidæ with those of *Procyon* and *Didelphys* would indicate that they were used mainly in slow terrestrial or arboreal locomotion, and exceptionally if at all in swimming.

Fig. 4. *Patriofelis ferox*, typical lumbar vertebra, posterior view.

2. *The Dentition.*

The lack of prehensile power in the feet of *Patriofelis* is compensated for in an extraordinary manner by the increased prehensile power in the progressive evolution of the teeth; this again is analogous to that of the Felidæ in its *extreme heterodontism* or specialization, whereas the key-note of dental evolution among the Pinnipedia is a *secondary homodontism* or reduction of the premolars and molars to a common triconodont pattern. The dental parallelism of the Oxyænidæ with the Felidæ is well stated by Wortman ('99, p. 140).

The progression of both skull and teeth in the Oxyænidæ is towards a raptorial type with increasing temporal and masseter muscles, deep zygomatic arch and large temporal fossa, heavy jaw, deep and broad symphysis, with the biting power concentrated at three points, namely, the canines, the fourth lower premolar, and the enormous carnassial teeth; the carnassials

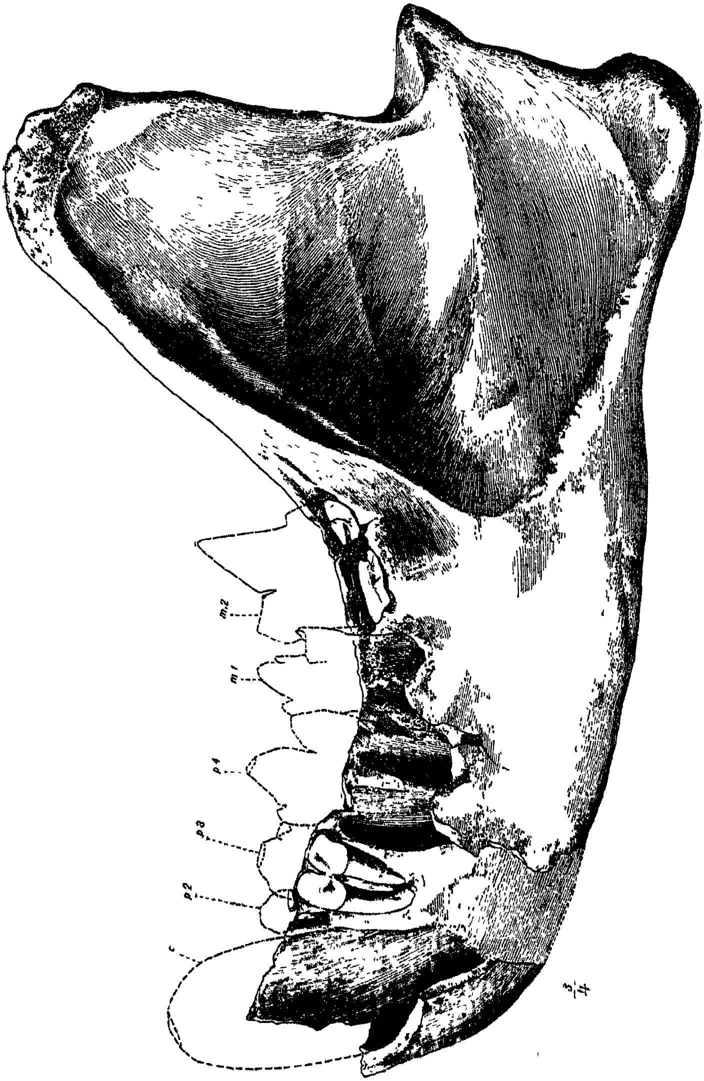


Fig. 5. *Patriofelis ferox.* Left lower jaw, external view (No. 1507 coll. A. M. N. H.). Specimen included in mounted restoration.

are adapted to flesh and bone cutting by the loss of the talonid exactly as in *Felis*. We should emphasize the contrast however :

	Carnassials	
Oxyænidæ	First upper molar	Second lower molar
Felidæ	Fourth upper premolar	First lower molar

II. Common Creodont Characters of the Oxyænidæ.

As stated above, many primitive Insectivore-Creodont characters are found in this family which are also found in other types. Among these are :

An alisphenoid canal ; exposure of mastoid (*Patriofelis*) ; small brain ; large temporal fossa ; cranium constricted behind the orbits (as in Mesonychidæ and Arctocyonidæ) ; powerful caudals ; elbows everted ; prominent deltoid crest and entepicondylar foramen of humerus ; separate scapho-lunar ; free centrale ; large trapezium ; small trapezoid ; femur with 3d trochanter and shaft expanded distally; astragalus with flat oblique tibial trochlea and astragalar foramen (as in Creodonta and Pinnipedia) ; small mesocuneiform (functionally analogous to the small trapezoid) ; distal phalanges cleft distally (as in many Creodonts and Condylarths) ; metapodials I–V relatively well developed.

III. Specialized Characters of the Oxyænidæ.

Progressive shortening of the face and elongation of cranium with reduction of teeth and development of jaw muscles ; high sagittal crest ; occiput narrow ; a preglenoid process ; a large postmastoid foramen ; no postglenoid foramina ; mandibular condyles scroll-like (as in Felidæ) ; atlas with form and vertebrarterial canal as in Felidæ (Wortman, '94, p. 137) ; axis with elongate spine ; certain dorsals and lumbars with progressively revolute zygapophyses (as in Mesonychidæ and certain Pinnipedia, *Phoca*) ; lumbars with progressively developed anapophyses ; scapula, humerus, and ulna of about equal length ; scapula very large, spreading superiorly (imperfectly known in *Oxyæna*), supra- and infraspinous fossæ subequal; powerful acromion and metacromion processes; humerus with exceptionally elongate and prominent deltoid crest, powerful supinator ridge, large entepicon-

dyle and entepicondylar foramen ; olecranon process of ulna elongate, ulna grooved anteriorly ; limited rotation of forearm owing to proximal expansion of radius ; feet spreading ; trapezium extended transversely (as in Pinnipedia, Wortman) ; dorsal portion of distal metapodial facets hemispherical, ventral portion keeled (as in Fissipedia, Wortman) ; digits angulate, the second

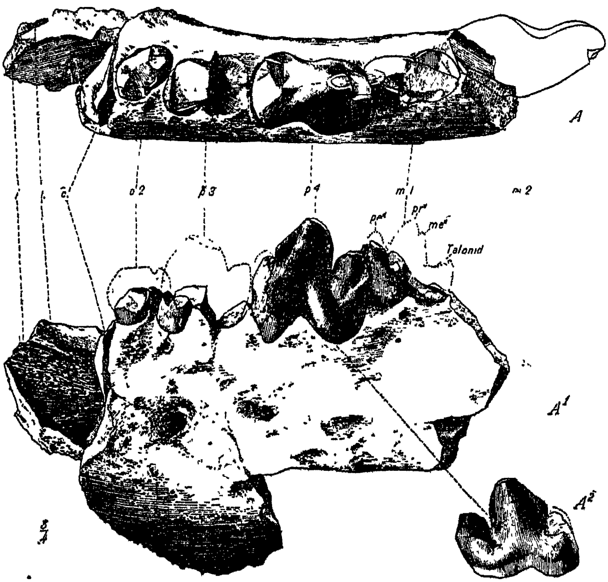


Fig. 6. *Patriofelis ferox.* Lower jaw, left side ; A, crown view ; A¹, external view; A² internal view of 4th premolar (No. 1508 coll. A. M. N. H.).

phalanges strongly flexed upon first phalanges ; subungual (retractile) processes of distal phalanges well developed (as in Pinnipedia ; in Fissipedia subungual processes small, foramen vestigial, Wortman) ; ilium expanded on superior (post-iliac) border into a broad lamina ; pubic symphysis not anchylosed ; patella large ; fibula unreduced, articulating with side of astragalus but not articulating with calcaneum (progressive) ; tibia with twisted shaft and cnemial spine ; tibio-astragalar facet flat, obliquely placed ; calcaneo-cuboidal facet very oblique ; large astragalo-cuboidal facets ; external calcaneal tubercle large (as in many Creodonts and Amblypods).

IV. Progressive and Specific Characters.

The above and the following characters show probably the *main trend of evolution in the* Oxyænidæ ; they are derived from a comparison of *Oxyæna lupina* (Wasatch, Sparnacien) and *Patriofelis ferox* (Bridger, Bartonien) ; it is important to note that *O. lupina* is an exceptionally slender species, some of its Wasatch contemporaries were more robust, whereas *P. ferox* is an exceptionally robust species. The differences between these species are therefore partly such as we should expect to find in the comparison of any slender and robust types, and partly truly progressive for the family.

Oxyæna lupina.	*Patriofelis ferox.*
Incisors $\frac{3}{3}$	? Incisors $\frac{?}{2}$
Canines sub-oval.	Canines laterally compressed.
Premolars $\frac{4}{4}$.	Premolars $\frac{3}{3}$.
Molars $\frac{2}{2}$.	Molars $\frac{1}{2}$.
First lower molar tuberculo-sectorial ; second ditto sub-sectorial with talonid preserving three reduced cusps.	First lower molar reduced, tuberculo-sectorial : second ditto truly sectorial with vestigial talonid.
Second upper molar transverse.	Ditto absent.
First upper molar sub-sectorial, with protocone relatively prominent.	First upper molar blade-like, sectorial, with protocone reduced and para- and metacones greatly elevated and connate.
Skull relatively slender.	Skull broad and massive.
Dorsals 13, lumbars 7 = 20 D.L.	Dorsals 14, lumbars 6 = 20 D.L.
	Sacrals 3 ; 2 sacrals uniting with ilium.
Caudals numerous.	Caudals 28, large chevrons.
Limbs, chest, and back slender.	Ditto robust.
Lumbars typical with simple zygapophyses ; small anapophyses on L 1–2.	Lumbars, massive, heavy, with extremely revolute zygapophyses ; anapophyses on L 1–4.
Tibia with short cnemial spine.	Tibia with elongate cnemial spine.
	Six sternebræ.
	Ribs heavy.

V. Systematic Revision.

Family *Oxyænidæ.* Terrestrial or arboreal Creodonts ; strictly carnivorous in habit ; enlarged canines ; second upper molars when present transverse ; powerful sectorials formed of first upper and second lower molars ; incisors,

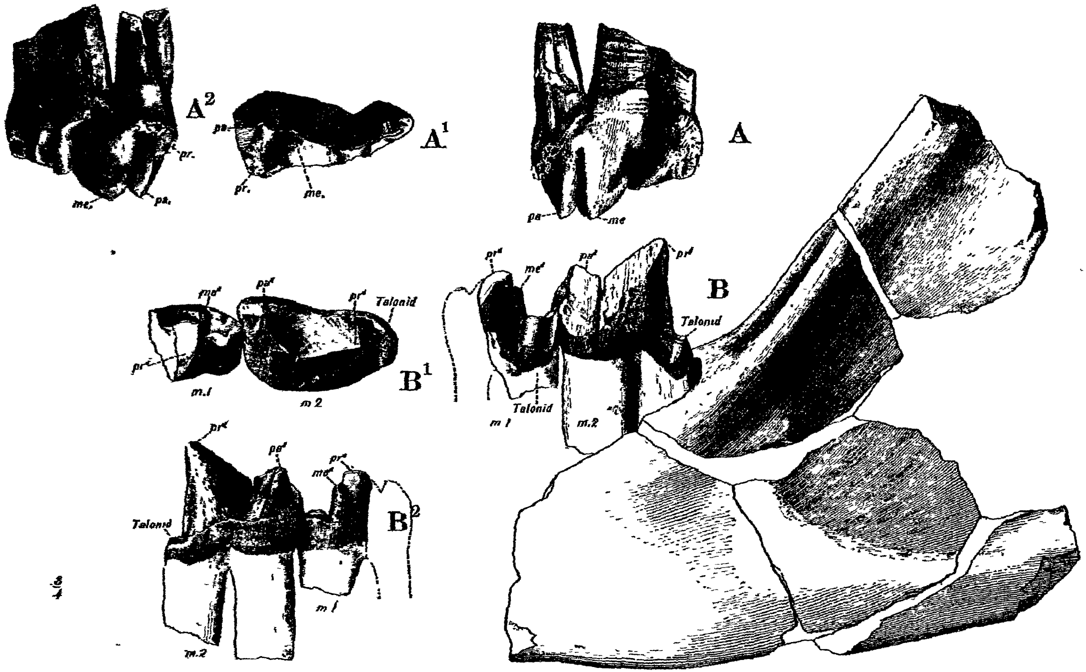


Fig. 7. *Patriofelis ferox.* A, external view; A^1, crown view; A^2, internal view of isolated 1st superior premolar (No. 2303 coll. A. M. N. H.). B, type of *Protopalsis tigrinus* (No. 4805 coll. A. M. N. H.); external view of jaw; B^1, crown view of 1st and 2d molars; B^2, internal view of 1st and 2d molars.

premolars, and molars progressively reduced and specialized; subdigitigrade, metapodials 5–5 spreading, not interlocking.

	Lower Eocene.	Middle Eocene.	Upper Eocene.
	Oxyæna Cope.	*Patriofelis* Leidy. Syn: Limnofelis Marsh. Protopalsis Cope.	*Oxyænodon* Wortman.
Dentition	$\frac{3}{3}.\ \frac{1}{1}.\ \frac{4}{4}.\ \frac{2}{2}. = 40.$	$\frac{3}{2}.\ \frac{1}{1}.\ \frac{3}{3}.\ \frac{1}{2}. = ?\ 32.$	$\frac{3}{3}.\ \frac{1}{1}.\ \frac{4}{4}.\ \frac{2}{2}. = 40.$
	Premolars with large talonids.	Premolars with talonids.	Premolars with small talonids.

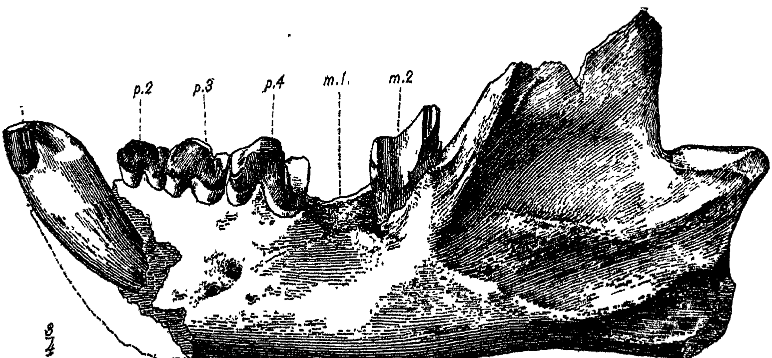


Fig. 8. *Patriofelis ulta.* Lower jaw, left side (No. 2691, coll. A. M. N. H.).

Dentition of Patriofelis.

The teeth of the animal are so distinctive that they deserve a detailed description; they exhibit a very decided evolution beyond those of *Oxyæna*.

Incisors.—The jaw (No. 1508) exhibits alveoli for two incisors, one of which is placed directly behind the other (Fig. 6).

Canines.—The alveolus and fang embedded in jaw No. 1508 indicate marked lateral compression of both fang and crown.

Lower premolars.—*First*, entirely wanting (Figs. 5, 6); *Second* (No. 1508), close to canine, two-fanged, with crown obliquely placed (see Fig. 6, A); *Third*, a somewhat larger tooth longitudinally placed, two-fanged, crown not preserved; *Fourth* (No. 1508, Fig. 6, A, A[1], A[2]), a triconodont type of tooth; enlarged, antero-posterior diameter of fangs = 210 mm.; a large central protoconid, an anterior cusp (broken away in No. 1508),

and a posterior cusp, or talonid, with a small basal postero-internal cusp.

Lower molars.—First, a relatively small tooth; antero-posterior diameter of fangs = 170; in No. 4805 the posterior half of the crown only is preserved; it exhibits the protoconid, a small elevated metaconid; the talonid is narrow and feebly tri-cuspidate; in No. 1508 the paraconid is partly preserved; *Second*, a powerful shear (No. 4508, Fig. 7, B) formed of an outwardly placed paraconid and a sharp elevated protoconid; the metaconid vestigial or represented by a very low ridge; the talonid reduced to a cingulum.

First upper molar.—(No. 2303, Fig. 7, A, and No. 1508, A, both teeth of the left side.) This is a powerful carnassial; the elongated shear (No. 2303) consists of the greatly modified trigon and metastyle; the protocone is depressed and reduced to a basal spur; the paracone and metacone consist of a pair of elevated connate subequal cusps; the metastyle is an elongate less elevated shear. In the greatly worn condition seen in No. 1508, A, as well as in No. 2691, *P. ulta*, the crown of the tooth retains its sharpness, proving that these teeth were employed as in *Felis*.

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Article XXI.—A BILATERAL DIVISION OF THE PARIETAL BONE IN A CHIMPANZEE; WITH SPECIAL REFERENCE TO THE OBLIQUE SUTURES IN THE PARIETAL.

By ALEŠ HRDLIČKA.

The first to describe a case of division of the parietal bone in apes was Johannes Ranke, in 1899.[1] The skull in question is that of an adolescent female orang, one of 245 orang crania in the Selenka collection in the Munich Anthropological Institute. The abnormal suture divides the right parietal into an upper larger and a lower smaller portion. "The suture runs nearly parallel with the sagittal suture," but, as the illustration shows (Fig. 1), it descends in its posterior extremity towards the temporo-parietal suture, and terminates in this a few millimetres in front of the lambdoid suture. The abnormal suture shows but little serration, and the articulation of the two divisions of the parietal bone is squamous in character, the lower portion overlapping the upper. Below the junction of the abnormal with the coronal suture, the latter takes a pronounced bend forward. A similar bend in the coronal suture is present in the same specimen on the left side. This is common among the other orang skulls in the collection. The portions of the coronal suture below and above the bend differ somewhat in character.

Besides the above-mentioned complete division, Ranke found among the 245 orang skulls 13 with incomplete division of the parietal bone. The division consisted invariably of a longer or shorter remnant of a horizontal "parietal suture," ending in the coronal suture at the top of the bend above referred to. A similar anterior remnant of an abnormal parietal suture was found by Ranke in a young chimpanzee skull; but the author questions the word "chimpanzee," which evidently means that the identity of the skull is somewhat doubtful.

In consequence of his finds, Ranke believes both complete and incomplete divisions in the parietal bone to be much more

[1] Die überzähligen Hautknochen des menschlichen Schädeldachs, Abh. d. k. bayer. Akad. d. Wiss., II Cl., XX Bd., II Abth., pp. 36 et seq., Fig. 17.

frequent in the orang than in man.[1] He also thinks that the bend usually present in the coronal suture in the orang signifies that, "even where there are no traces of a parietal suture, such a suture has actually existed in an earlier stage of development." This implies the development of the adult parietal bone in the orang from two original segments, one above the other.

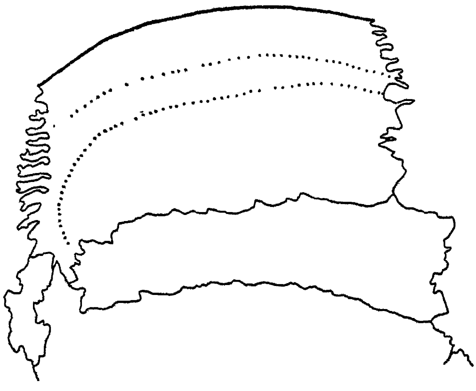


Fig. 1. Division of the Right Parietal in an Orang (Ranke, Abh. d. k. bayer. Akad. d. Wiss., II cl., XX Bd., ii Abth.).

The divisions which I am about to describe occur, one in each parietal, in the skull of a nine-year-old male chimpanzee, which was captured, when young, in West Africa. Later on he was one of the attractions of the Barnum and Bailey Circus, and was familiarly known as Chico. The chimpanzee died in 1894, since when his skin and bones have been preserved in the American Museum of Natural History, New York City. Prof. J. A. Allen, the curator of the Zoölogical Department of the Museum, has kindly given me permission to describe the skeletal parts for publication.[2]

The most interesting part of Chico is unquestionably the skull. The divisions of the parietal bones which the specimen presents are not only the first complete divisions of the parietal observed in a chimpanzee, but are also unique in character, no divisions of the same nature having been observed before, either in man, in apes, or in monkeys. The position and extent of the divisions in this skull will throw considerable light on the question of the

[1] *L. c.*, p. 41. Among 3000 Bavarian crania, Ranke found but one with complete and three with incomplete parietal sutures; basing his conclusion on this observation, he says, "Bei den Orangutanschädeln ist die Häufigkeit der Scheitelbeinnäthe circa 40 mal grösser als bei dem erwachsenen Menschen."

[2] Since finding the abnormal sutures on this skull, I have been able to present the same at a meeting of the Association of American Anatomists (1899) and before the Ethnological Society of New York City (1900).

aberrant, complete divisions of the parietal bone, by which term may be designated divisions differing from the typical horizontal ones.

The skull under consideration shows in general a good development and an almost perfect symmetry. The capacity of the brain cavity, measured according to Flower's method, is 390 c.c.

The masculine features of this skull, and particularly the temporal ridges, are not quite as marked as those of another skull of an adolescent male chimpanzee in the Museum. The temporal ridges are slightly prominent, and in their middle third, over part of the frontal and the parietal bones, not more pronounced than in some human crania. They are, however, situated very high. Their upper lines or boundaries touch each other over a part of the sagittal suture, a little back of the bregma; while the lower lines approach to within 6 mm. of the sagittal suture. The supraorbital ridges are not very massive, although prominent to such a degree that, when the skull rests on the occipital condyles and on the teeth, the plane of the orbits is almost vertical. The sagittal crest is insignificant; the occipital crest is high, but not very massive. The zygomatic arches are less strong than they are in an average white male; and the mastoids are small, even smaller than in an average adult white female.

The second dentition is incomplete; the third molars have not reached the level of the opening of their sockets. The condition of the sutures, so far as their patency is concerned, does not bear the same relation to the stage of dentition as it does in man: all the sutures of this skull are more or less obliterated. There are no signs on any part of the skull that point to the closure of any of the sutures as premature. In detail, the condition of the sutures is as follows: The spheno-maxillary articulation is completely closed, but still plainly traceable. Of the various facial sutures, only remnants are open; the suture in the zygomatic arch, however, is almost fully patent on both sides. The spheno-frontal articulation is completely obliterated on the left, but traces of it remain on the right side. The left temporo-sphenoidal and squamo-frontal sutures (the squama of the temporal articulates with the frontal bone) are, with the exception of the basal part of the former, which remains open, quite obliterated, but on the right side both are open. The temporo-parietal

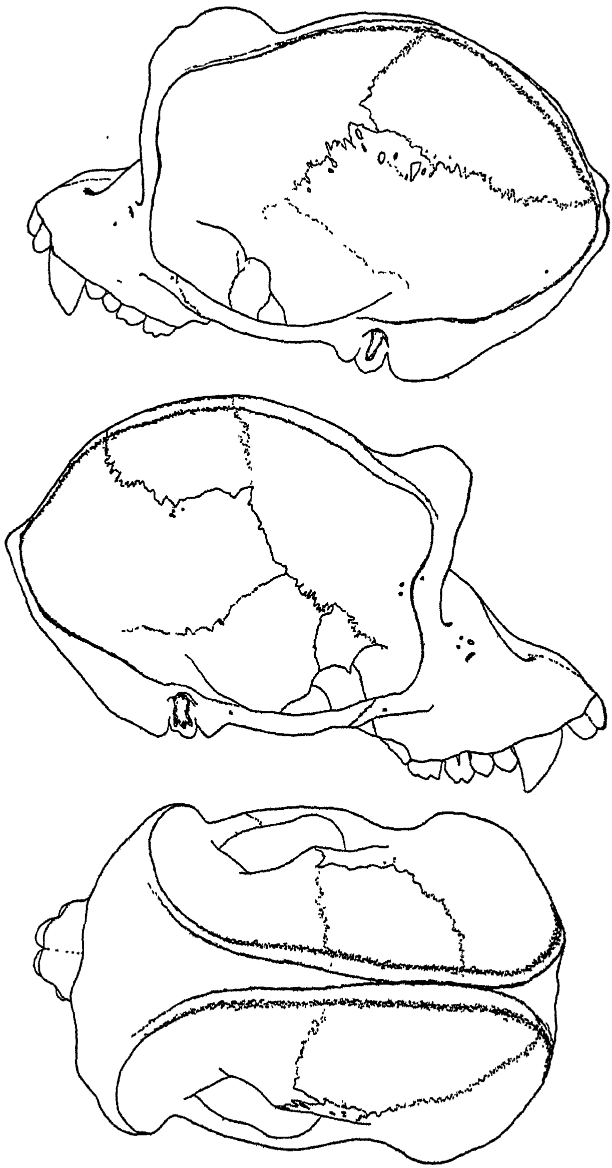
sutures, with the exception of 8 mm. of the anterior end of the suture on the right side, are both entirely closed and hardly traceable. The coronal suture is partly open on the left, and wholly open on the right, up to a point a little below the middle of the anterior border of the parietal bone. At this point on each side, the lower portion of the coronal suture bends backward and continues as the anomalous suture; the upper portion of the coronal, particularly on the right, is completely obliterated, though still traceable. There are no signs left of the sagittal and lambdoid sutures, and only the basal portions of the temporo-occipital articulation remain. The palatine sutures, also, are entirely obliterated.

The skull shows no important anomalies besides the division of the parietals.

The divisions of the parietal bones begin on the left 32 mm., on the right 28 mm. (measured with a tape), above the point of junction of the coronal and temporo-parietal sutures. From the point where the anomalous sutures leave the coronal suture, to the bregma, the distance on the left is 44 mm., on the right 42 mm. The excess of size of the left over the right parietal bone along the coronal suture (6 mm.) compensates the greater height of that portion of the right temporal squama which articulates with the frontal bone. Measured across their middle from the temporo-parietal suture, the two parietals appear to be almost of equal size (left 82 mm., right 80 mm.). In an antero-posterior direction, from the beginning of the division to the middle of the parietal portion of the occipital crest, both bones measure the same, namely 75 mm.

The division in the left parietal begins at a V-shaped cleft, which is filled with a process of the frontal bone. There are slightly distinct markings on the bone and a number of insular ossicles, which make it probable that the cleft had been originally much greater and was largely filled by a Wormian or, rather, a fontanel bone, the lower border of which has subsequently united with the parietal.

For 30 mm. from its beginning the abnormal suture proceeds directly backward, and to this extent shows but little obliteration. The original cleft has, it seems, extended up to this point. From here the suture takes a slight bend upwards, and proceeds



Figs. 2–4. Skull of an Adolescent Male Chimpanzee.

almost directly upwards and backwards, becoming gradually obliterated, until it disappears at the temporal ridge, 16 mm. from the median line. Originally the suture must have terminated on the posterior border of the parietal bone, not far from the lambda. The whole suture shows fairly good serration. The coronal suture on this side, below the division, shows serration about equal to that of the abnormal suture; the obliterated portion above this was, so far as can be seen, more simple.

On the right side the division of the parietal may also have begun with a cleft in the anterior border of the bone, but, owing to the advanced state of obliteration of the upper portion of the coronal suture on this side, the existence of the cleft cannot be fully ascertained. Here also the abnormal suture, at first wholly open, runs for the first 26 mm. directly backwards; at this point the suture, still quite patent, takes a turn somewhat sharper than that on the left, and proceeds for 16 mm. backwards and upwards; here it takes a second turn, and proceeds almost directly upwards towards the sagittal suture. This last portion of the abnormal suture is considerably obliterated, and on and beyond the temporal ridge is scarcely traceable. The point at which the division has reached the sagittal suture is situated a little behind the middle of the latter. The abnormal as well as the open part of the coronal suture on this side shows a simpler serration than the corresponding sutures on the left side.

In this specimen there is on neither side any encroachment of the lower portion of the parietal bone upon the frontal, such as Ranke lays stress on in the case of his orangs. A second skull of an adolescent male chimpanzee, in the Museum of Natural History, has a decided bend in the coronal suture, not unlike that which Ranke describes, and which, as he thinks, generally indicates an old parietal division; but in this case the bend is situated between the inferior and superior boundaries of the prominent temporal ridge, and apparently owes its origin to the latter (Figs. 2, 3, 4).

The main interest in the case just described centres in the direction of the abnormal sutures, and in the clearness with which the two divisions appear as equivalent and of the same origin, although one divides the parietal completely, while the other is restricted to one of its angles.

As to the course of the abnormal suture in the parietal bone, in all the cases thus far reported, the division runs in a horizontal direction (cases of Tarin, Soemmering, Gruber, Hyrtl, Welcker, Turner, Putnam, Dorsey, Ranke, and others); or it runs obliquely from or near the middle of the lambdoid suture to some part of the temporo-parietal suture, the sphenoidal angle, or the lower portion of the coronal suture (cases of Curnow, Ekmark, Gruber, Hyrtl, Lucae, Welcker, Putnam, Traquair, Ranke); in a case of *Simia silenus* described by Gruber and in an Egyptian cranium described by Smith, the divisions run to the lambda and begin respectively slightly above the pterion and at it. In Boyd's and in two of Hyrtl's cases, the abnormal suture begins at or below the bregma on the coronal margin of the parietal bone, and ends at or near its mastoid angle; finally, in Blumenbach's (cited by Welcker), Bianchi's, Fusari's, and Coraini's cases (those of Coraini include two monkeys) the division is vertical, passing between the temporo-parietal and sagittal sutures. The left division in our chimpanzee approaches those in Gruber's *Simia silenus* and Smith's cases; but it originates much higher anteriorly, and terminates slightly below the lambda on the occipital border of the parietal. The division in the right parietal of the chimpanzee, beginning slightly below the middle of the anterior border of the bone, and ending slightly back of the middle of its sagittal border, has no analogy among the cases previously described.

The difference in extent and terminations of the two abnormal sutures in the chimpanzee is of particular interest in connection with the problem of the significance and origin of those divisions of the parietal bone that involve more or less only one of its angles.

Since the observations of Toldt,[1] and more recently of Ranke,[2] on the development of the parietal bone in the human embryo, it appears, though it cannot as yet be said whether the fact is or is not general, that the bone originates from two centres of ossification. These centres appear in most cases one directly above the other, but, as Ranke himself shows,[3] and as can hardly be otherwise, these primitive components of the parietal do not always

[1] Toldt, C., in Maska's Hdb. d. gerichtl. Med., 1882, v. III, p. 515; the same in his U. d. Entwick. d. Scheitelbeins d. Menschen, Zeitschr. f. Heilkunde, 1883, v. IV, pp. 83–86.
[2] *L. c.*, pp. 324–330.
[3] *L. c.*, pp. 327–330, Figs. 29–32.

show the same relations in size or position. The centres blend together, ordinarily, at the end of the third or during the first half of the fourth month of fœtal life. On this account, the typical, complete, horizontal division of the human parietal bone, when met with at any time after the fourth month of fœtal life, is generally interpreted to-day as a retardation of the union, or a persistence of separation, of the two original segments of the bone. Opinion, however, is still unsettled as to the significance of the more atypical, oblique divisions of the parietal, particularly of those where the separation is limited to one angle. Up to the recent contribution on the subject by Ranke, the weight of opinion on the point, although rather briefly expressed, seems to have been in favor of attributing to these smaller, oblique divisions, the same significance as was given to the more typical, horizontal ones. Gruber,[1] in reporting a new case of a bilateral oblique suture in the parietal bone, calls the separated mastoid angles "the secondary posterior parietals." Hyrtl and Welcker advance no definite theories on this point, though the latter expresses an opinion[2] that in both the horizontal division and the separation of the mastoid angle of the parietal bone the development of the condition may be identical. In 1883 Prof. F. W. Putnam, in describing one of his Tennessee skulls with an abnormal oblique suture in each parietal,[3] referred the development of the separated mastoid angle on the right side, as well as the larger oblique inferior portion of the parietal on the left side, to a "separate centre" of ossification. Ranke[4] opposes both Gruber's and Putnam's opinion, and presents instead a theory somewhat vague and not satisfactorily demonstrated, by which he accounts for the origin of oblique sutures from partial horizontal sutures in the parietal bone through "half-pathological processes." In his words, "the oblique parietal suture is allied to the half-pathological conditions of the skull; it is wholly unjustifiable to speak, as W. Gruber has done, of a separate Parietale secundarium posterius, severed by the suture, as of a typical, in a certain sense normal, formation. The oblique parietal suture is nothing more

[1] Gruber, W., Beobacht. a. d. menschl. u. vergl. Anat., Berlin, 1879, II Heft, pp. 12–15.

[2] Welcker, H., Untersuch. ü. d. Wachsthum u. Bau d. menschl. Schädels, Leipzig, 1862, p. 109.

[3] Putnam, F. W., Abnormal Human Skulls from Stone Graves in Tennessee (Proc. A. A. A. S., XXXII, 1884, p. 391).

[4] *L. c.*, p. 309.

than an incomplete (posterior), true, *i. e.*, typical, parietal suture with a sagittal course, modified by certain half-pathological conditions." These half-pathological conditions are produced, the author explains on the preceding page, "durch Einknickung der nach Herrn G. H. Meyer 'plastisch' aufwärts gebogenen hinteren Scheitelbeinränder."

This opinion of Ranke calls for a few words about the incomplete horizontal parietal sutures. These sutures are apparently very rare in human adults, only five instances being on record (4 Ranke's, 1 Turner's). They are more frequent in orangs (Ranke), and quite common (as Ranke shows, and as I found independently before Ranke's publication of his observations) in the human embryos near term and in new-born or very young infants. In the human family, these partial divisions of the parietal generally begin in the posterior part, and run sagittally to the posterior border of the bone, ending in this border at or near its middle. In orangs the incomplete horizontal divisions seem to begin, as a rule, in the anterior part, and end at or near the middle of the anterior border of the parietal. The length of these divisions varies from a few millimetres to several centimetres, and they even reach up to the centre of the parietal bone.[1] These divisions are, without doubt, the remains of the original anterior and posterior clefts, or, if we go a step further, of the original intervening antero-posterior space between the original inferior and superior segments of the parietal. From the very first contact of the growing centres, the median extremity of these clefts is bounded both below and above by a mass of bone; and when the anterior or posterior border of the parietal comes finally in contact with the frontal or occipital bone, the anterior and posterior sagittal clefts, if they still exist, lie between two well-developed, firm portions of the bone. Under these circumstances it is quite impossible to imagine any disturbance, mechanical or pathological, that could affect solely or mainly the median portion of the cleft, and cause a deflection downward in this portion of the division, or cause its extension to the inferior border or even the anterior-inferior angle of the parietal.

There are only two factors that can possibly affect and modify

[1] Ranke's Fig. 25, p. 318.

the course of the incomplete parietal suture, and both of these would show their influence mainly or entirely on the distal portion of the same. These two factors are, first, an abnormal development, either defective or excessive, of one of the original parietal segments ; and, secondly, influences that would interfere with the freedom of full growth of the anterior or posterior border of the parietal.

In the first case, as can easily be imagined or even artificially demonstrated, there would be possible only a lower or higher situation or an obliquity affecting mostly the marginal portion of the division. The results would be low or high sagittal sutures, and curved or oblique sutures diverging from the parietal eminence,—effects entirely different from the actually observed oblique sutures that sever the lower portion of the parietal, or its mastoid angle.

Influences interfering with the free development of the anterior or posterior border of the parietal bone could only deflect upwards or downwards the marginal end of an incomplete parietal suture, or, at most, in a case of a short suture, render it oblique or curved in its entirety. No pathological condition, unless it were accompanied by a fracture, could extend even a deflected antero-posterior incomplete division to any of the borders of the bone.

There are, it seems to me, only three possible ways in which an oblique suture, extending between any two borders of the parietal bone, can be produced.

In the first case the oblique suture, or rather a suture-like formation, may be the effect of an early fracture. A fracture produced in adult life is generally recognizable as such ; but a fracture dating from earlier stages of life, produced before the growth of the bone has ceased, may, if not entirely obliterated, present more or less the characteristics of a suture. I have seen several skulls where a division in the parietal bone or the temporal squama presented at the same time features of a fracture and suture; in one or two of these cases so much so, that it was and still is impossible for me to decide exactly which of the two conditions I had before me. Gruber describes one such case[1] as an instance of an oblique parietal suture, while Hyrtl and Ranke both consider this case as one with an acquired division.

[1] Virchow's Archiv, 1870, v. 50, p. 113.

To differentiate a congenital real oblique suture from a division which is the result of a fracture, we must be guided largely by the situation, form, and serration of the division, and the condition of the surrounding bones, especially that of the opposite parietal. A straight course, ending with one extremity in or near the middle of the anterior or posterior border of the parietal, a complex serration, no continuity of the division on the neighboring bones, and particularly a co-existence of an allied or similar division on the opposite parietal,—all favor the conclusion that the division under consideration is a real congenital suture, and not the result of a fracture.

In the second case there are reasons for believing that an oblique suture of the parietal bone can originate in the same way as the horizontal one, namely, through a persistence of the original separation between the two centres from which the bone is developed, and a co-existent difference in the relative position or the relative growth of the two centres. It is in this connection that the above-described division in the parietals of the chimpanzee will prove of value.

The occasional persistence of the separation between the two original segments of the parietal bone is sufficiently demonstrated by the presence of the complete horizontal parietal suture. Differences in the relative position of these segments can be observed in a limited degree in Ranke's illustrations of embryos, before referred to; it can be deduced from such cases as the two of Hyrtl,[1] in which the division of the parietal was directed from the upper portion of the anterior to the lower portion of the posterior border of the bone. The most pronounced change in the position of these centres may be witnessed in cases where the parietal bone shows a perfect vertical instead of a horizontal suture. Such cases have been referred to before, and I presented at the meeting of the Association of American Anatomists, in 1899, several such examples, found by me in skulls of monkeys in Professor Huntington's anatomical collection in the Medical Department of Columbia University. One of these specimens is shown in the accompanying illustration (Fig. 5).

A difference in the relative growth of the two centres of the

[1] Hyrtl, J., Die doppelten Schläfenlinien d. Menschenschädel, etc. (Denkschr. d. math. naturw. Classe d. k. Akad. d. Wiss. zu Wien, 1871, v. XXXII, pp. 39–50).

parietal bone is well shown in the difference of size between the inferior and superior portions of the parietal in cases of the complete horizontal suture in the same. In the majority of such cases on record the superior portion is larger, particularly anteriorly, than the inferior; so much so, that that condition seems to be the typical one. The difference in the size of the two portions of the parietal, and in their relative anterior and posterior height, is most pronounced in one of Gruber's cases,[1] where the "parietal suture" begins only 10 mm. above the pterion, and ends 40 mm. above the asterion. In Dorsey's case[2] the lower portion of the divided parietal is 12 mm. higher than the upper. The same condition as is found in Gruber's case, here mentioned, exists in the almost identical left division of the second case of Putnam, of which I have a photograph in my hands. A somewhat similar excess of the posterior over the anterior part of the lower severed portion of the parietal can also be seen in the illustrations of the cases of Tarin, Lucae, and Turner (Admiralty Islands skull). In Calori's interesting case[3] there is a decided excess of the lower portion of the divided parietal in its posterior portion on the left and in its anterior portion on the right side.

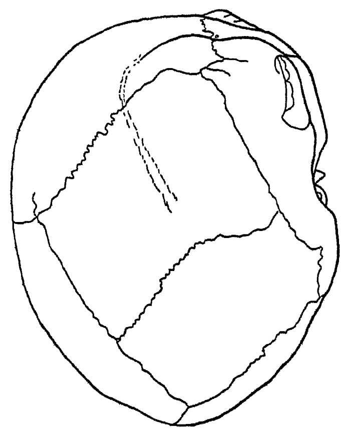


Fig. 5. *Macacus rhesus* (Medical Department, Columbia University), showing a Complete Division of the Right Parietal Bone in a Vertical Direction.

In case the upper segment was not vertically above the lower one, but in a position a little more forward or backward of it; and, furthermore, if the relative growth of the two segments differed, and their separation remained permanent,—the separation of any portion of the parietal bone in almost any form and to almost any extent might result. Such coincidence of anom-

[1] Gruber, W., Beobacht. a. d. menschl. u. vergl. Anat., Berlin, 1879, II Heft, p. 15.
[2] Dorsey, G. A., Chicago Med. Recorder, v. XII, Feb., 1897.
[3] Calori, Luigi, Sut. soprannum. d. Cranio Umano (Mem. d. Accad. d. Sc. d. Ist. d. Bologna, 1867, pp. 327 et seq., Fig. 4).

alous conditions, although necessarily rare, cannot, from what we know on the subject in parietal and other bones, be declared improbable. All cases where oblique suture on one side co-exists with more or less horizontal suture on the other side in the parietal bone, as in the second of Putnam's cases, would of course point directly to a similar origin of the anomaly on both sides of the cranium. That such cases have not been more frequently observed is largely due, I think, to the rarity of bilateral parietal divisions.

A third mode of development of the oblique suture in the parietal bone suggests itself where the severed portion of the bone is small, and that is the possible existence of a supernumerary, third centre of ossification. I am by no means ready to defend this theory, yet there are cases in which it would afford the easiest explanation. I have a Peruvian skull at hand, in which there is a bilateral, quite symmetrical quadrangular separate piece of bone, encroaching on the mastoid process of the parietal. The surface of the left parietal bone in this skull measures across its middle in antero-posterior direction 120 mm., in infero-superior direction 130 mm.; similar measures of the right parietal are respectively 117 and 130 mm. The separate bone on the left measures across its middle in antero-posterior direction 20 mm., in infero-superior direction 12 to 21 mm.; the same portion on the right measures respectively 25 and 11 to 15 mm. Both pieces are joined to the parietal bone by a squamous suture (Fig. 6).

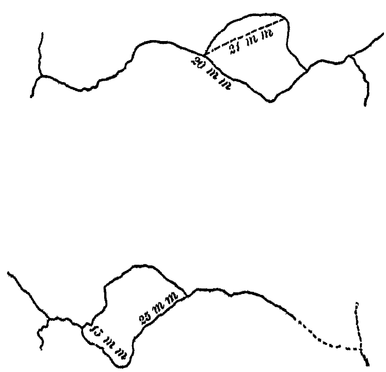


Fig. 6 ($\frac{88}{3880}$). Quadrilateral Fontanel Bones in a Peruvian Male Skull, encroaching upon the Mastoid Angle of the Parietals.

It is apparent that the separate pieces of bone in this case are too small to be easily taken for representatives of one of the regular centres of ossification of the parietal bone; but the same pieces are somewhat too large, and especially too singularly outlined and joined to the parietal, to be without difficulty diagnosed as simple Wormian or fontanel

bones. One of Ranke's cases,[1] though the separation of the mastoid angle is oblong instead of quadrangular, as in the Peruvian skull, seems to me to present a similar difficulty in properly diagnosing the nature of the severed portion. This group of cases needs further observation, particularly on the bones of infants and embryos. I have two monkey skulls at hand which actually show a multiplicity of the original segments of the parietal. These specimens will be described in a future publication.

So much as to the *formation* of the oblique sutures in the parietal. It should not be forgotten that such sutures can be *simulated* by those which divide true Wormian or fontanel bones from the parietal. The distinction between the real oblique parietal and these extra-parietal sutures must depend largely on the extent of the division and form of the separate piece of bone.

We may now return to the skull of our chimpanzee. In considering the nature of the divisions in the parietal bones of this skull, we can at once and absolutely discard the idea of the divisions being due to fractures, or being boundaries of Wormian or fontanel bones, and thus really extra-parietal in their nature. There is nothing about the sutures, or the divided pieces, or the neighboring bones, that would even suggest such an explanation; and in our records on Wormian and fontanel bones we find no analogies either in man, or apes, or lower animals, to the conditions here observed. The necessary conclusion from this can only be that we have before us two examples of real parietal division.

The division on the left side, had it existed alone, would be readily acceptable as an instance of the "parietal suture." The anterior extremity and more than the anterior third of the course of the division correspond exactly to the same features of a typical, horizontal "parietal suture;" while the elevation of the posterior extremity of the division, though unusual, can readily be explained as due to an excess in growth of the inferior original centre of the bone, which may, in addition, have been situated slightly posterior to the upper centre.

The division in the right parietal of the chimpanzee begins at its anterior end, and runs for the first third of its course in the same way as that on the left side; its posterior end, however,

[1] *L. c.*, p. 303, Fig. 13.

does not reach the lambdoid, but turns up and ends in the sagittal border. Should this formation have existed alone, I should be inclined to consider it either as the result of an accessory centre of the parietal, or, possibly, as a persistence of the anterior portion of the divided superior centre of the bone, the posterior portion of the same being united with the lower segment of the parietal in the usual way. With the division of the left parietal in the same skull before me, everything points to a similar origin of the division on both sides, and to the right as well as the left division being a true "parietal suture," deflected less on the left and more on the right side by a disproportion in growth of the two original, regular segments of each of the bones.

The disproportion of growth of the two original segments of the parietal bone will, I believe, be found more common as attention is directed to this subject. It can be well explained, though there may at times be other factors present, by a difference in the blood-supply to the two centres. This of course may occur not only in different skulls, but also on the two sides of the same cranium.

Article XXII. — A STUDY OF THE GENUS STURNELLA.

By Frank M. Chapman.

The genus *Sturnella* ranges from northern South America to the Plains of the Saskatchewan and includes two types or forms, one of which is dark, the other, light in color. The former, *Sturnella magna*, is distributed throughout northern South America, from Guiana to Bogota, and thence through Central America and Mexico, to the United States east of the one hundredth meridian and northward to the Great Lakes. It is also found in Cuba. In this wide area it is subject to considerable variation in color and size, characters which have formed the basis for the description of several races. These races, including the type form, with their ranges, are as follows :

1. *Sturnella magna* (Linn.). United States east of the one hundredth meridian, except southern Florida. (Based on Catesby's *Alauda magna*.)
2. *Sturnella magna argutula* Bangs. Southern Florida. (Type locality, Hillsboro County, Florida.)
3. *Sturnella magna hippocrepis* (Wagl.). Cuba. (Type locality, Cuba.)
4. *Sturnella magna mexicana* (Scl.). Tableland and temperate portions of southern Mexico northwards along the humid bases of the Sierras. (Type locality, Jalapa.)
5. *Sturnella magna inexpectata* Ridgw. East coast region of Central America and Mexico north to Vera Cruz. (Type locality, Segovia River, Honduras.)
6. *Sturnella magna alticola* Nels. Pacific coast of Mexico from Tonala, Chiapas, southward through the highlands, at least to Dueñas, Guatemala. (Type locality, Ocuilapa, Chiapas.)
7. *Sturnella magna meridionalis* (Scl.). Northern South America from Guiana to Bogota. (Type locality, Colombia.)

The lighter form, currently known as *Sturnella magna neglecta*, occupies the United States west of the ninetieth meridian and

ranges northward to the Saskatchewan and British Columbia and southward to Northern Mexico. It is subject to comparatively little variation, only one form of it having been described, the *Sturnella magna hoopesi* of Stone from the lower Rio Grande (type locality, Brownsville, Texas), which, through insufficient material, Mr. Stone erroneously believed to be the northern representative of *Sturnella magna mexicana*. The variations of *Sturnella magna* and *Sturnella neglecta*, *inter se*, present no unusual complications, but the relationships of the two forms to each other have long constituted one of the leading problems in the classification of North American birds, and its solution is the object of the present paper ; the greatly increased collections from previously unrepresented areas, now giving the investigator opportunities which have before been lacking.[1]

The radically different views which have been held by leading ornithologists, concerning the inter-relations of the eastern and western Meadowlarks, are well represented in the following quotations :

Coues.

Coues, 'Birds of the Northwest.'

"The case of *Sturnella magna neglecta* is settled and explained ; *magna* shades directly into *neglecta*, and develops its peculiarities precisely according to the mean annual rain-fall, and consequently the average humidity of the atmosphere of the regions in which it resides. The change is imperceptibly effected ; distinguishable examples sometimes occur together ; the characters culminate in the most sterile regions."

Ridgway.

Ridgway, 'Manual of North American Birds.'

"Without much doubt a distinct species. The occurrence of both *S. neglecta* and *S. magna* together in many portions of the Mississippi Valley, each in its typical style (the ranges of the two overlapping, in fact, for a distance of several hundred miles), taken together with the excessive rarity of intermediate specimens and the universally attested radical difference in their notes, are facts wholly incompatible with the theory of their being merely geographical races of the same species."

In attempting to determine the exact relationships of *magna* and *neglecta* neither of the authors above quoted had material from which they could determine the relationships of *neglecta* to

[1] By far the most important of this recently collected material was secured by Dr. E. A. Mearns along our southern boundary, while acting as naturalist to the Boundary Survey ; and by E. W. Nelson in Mexico, during his explorations for the Biological Survey.

the representative of *magna* on the tableland of Mexico, or at the southern limit of the range of *neglecta*, and in going into the subject in detail it at once became apparent that an attempt to learn the relationships of the Meadowlarks of the eastern and western United States involved a study of the entire group. We may, therefore, first consider *magna*, then *neglecta*, their range and variations *inter se* as a preparation for the study of their interrelations. It should be stated at the outset, however, that the material to which I have had access is far from satisfactory; and an explanation of the facts it apparently presents is to be regarded only as provisional. We need large series of breeding birds from northern Mexico, taken by a collector who is thoroughly familiar with the points involved, before we can reach conclusive results. In the meantime the following study is presented as perhaps embodying certain views not previously advanced.

GEOGRAPHICAL VARIATIONS OF *Sturnella magna*.

Sturnella magna (Linn.). — Our familiar eastern Meadowlark varies but little throughout most of the eastern United States. Specimens from the lower Mississippi Valley and eastern Gulf States, except Texas, average darker and this difference, which is slight, reaches its maximum in southern Florida. Northern birds have a longer wing but relatively shorter bill and tarsi than those from the south.

To the hardened 'splitter' these variations might seem deserving of recognition by name, but, in my opinion, with the possible exception of those of the south Florida bird, they are too intangible to warrant such a course.

Sturnella magna argutula Bangs.—The Florida bird, especially in the southern half of the State, is smaller than specimens from the northern States, the wing being about half an inch shorter, but the tarsus and culmen are of about the same length as in northern examples, and relatively, therefore, are longer.

A very careful comparison of specimens in the same stage of plumage fails to show any constant differences in color by which the Florida bird can always be distinguished from northern birds. The yellow of the underparts averages a shade deeper and the general tone of the upperparts is darker, particularly in

specimens from the southern part of the State, while the occasional presence of spots on the breast indicates an approach to the Cuban bird.

These differences were in part commented on by Allen in 1871, and in 1888, I referred the Florida bird to *mexicana.*

The excellent series of true *mexicana* which Mr. Nelson has since secured, and which I have been permitted to examine, shows that although agreeing with the Florida bird in size it differs in the narrowness of the pectoral crescent and in the coloration of the back, the feathers of which are less deeply tipped with chestnut and more widely bordered with bay than in Florida examples.

Mr. Stone has also pointed out these differences, and he concludes his study of the Florida bird by saying it is "certainly impossible to separate"[1] it, and it has remained for Mr. Bangs to exhibit the courage which his predecessors have lacked by 'splitting' the Florida form under the name *Sturnella magna argutula.* If the application of this name be restricted to the isolated Florida bird, it may prove a convenient means of expressing the slight differentiation which that form exhibits. If, however, as its proposer suggests, it be applied to Gulf Coast and lower Mississippi Valley specimens, it will only result in the confusion which always follows our attempts to definitely name differences which do not definitely exist.

Sturnella magna hippocrepis (Wagl.).—The Cuban bird has a shorter wing and bill than the bird from southern Florida, but the tarsus is of the same length as in birds from that State. In the color and pattern of the upper parts it resembles the south Florida form, but the sides average more heavily streaked and black spots extend to the yellow of the breast and abdomen. The breast crescent in some specimens is very narrow, but in most cases is not relatively smaller than in *magna.* While the Cuban Meadowlark is isolated by an insular home from other forms of this genus it sufficiently resembles southern Florida examples to permit of the difference between the two being bridged by individual variation.

Sturnella magna mexicana (Scl.). —This form is smaller than *S. magna,* the wings and tail being shorter, but the tarsus is actu-

[1] Proc. Acad. Nat. Sci., 1897, 150.

ally as well as relatively longer. In color, average specimens of *mexicana* resemble *magna* but differ in having the feathers of the back less widely bordered, laterally, with bay of a slightly brighter color than in *magna*.

In spring specimens of *mexicana* the chestnut tip of the back feathers largely disappears, when the greater width of the bay lateral margins and smaller black area of the dorsal feathers are more evident than in the fall, giving to specimens taken at this season a certain ruddy tinge wanting in *magna*. This difference is more evident in birds from the coast region (*inexpectata*) and less pronounced in specimens from the tableland.

The pectoral crescent in *mexicana* averages narrower than in *magna*, and the yellow of the throat shows a tendency to spread to the malar region, as in *neglecta*, this character being more strongly marked in specimens from the mountain region of southern Mexico to Costa Rica, in many of which the yellow of the throat is as widely spread as in average *neglecta*.

Sturnella magna inexpectata Ridgw. — This is a small form of *mexicana*, which it resembles in color, but is more ruddy.

Sturnella magna alticola Nels. — Mr. Nelson has lately applied this name to southern highland representatives of *mexicana*, which have been alluded to above as sometimes having the sides of the throat yellow. Birds from the range assigned to this form appear to differ little if at all in size from true *mexicana*, but, as stated above, usually have more yellow on the sides of the throat.

Sturnella magna meridionalis (Scl.).—Enough specimens of the South American bird are lacking to satisfactorily determine its characters. It appears to resemble *mexicana* in color, but to have a much longer bill. Much variation is shown in the distribution of the yellow of the throat, which in some specimens is as widely extended as in *neglecta*, and in others as restricted as in *magna*. It is probable that when an adequate number of specimens of the South American bird have been secured from both the coast and highlands it will be found to differ much as do examples from southern Mexico.

Summary. — From this brief survey of the variations of *Sturnella magna* it is evident that throughout a range which reaches from South America to Canada it presents no marked variations in color. Indeed, to the untrained eye specimens from South

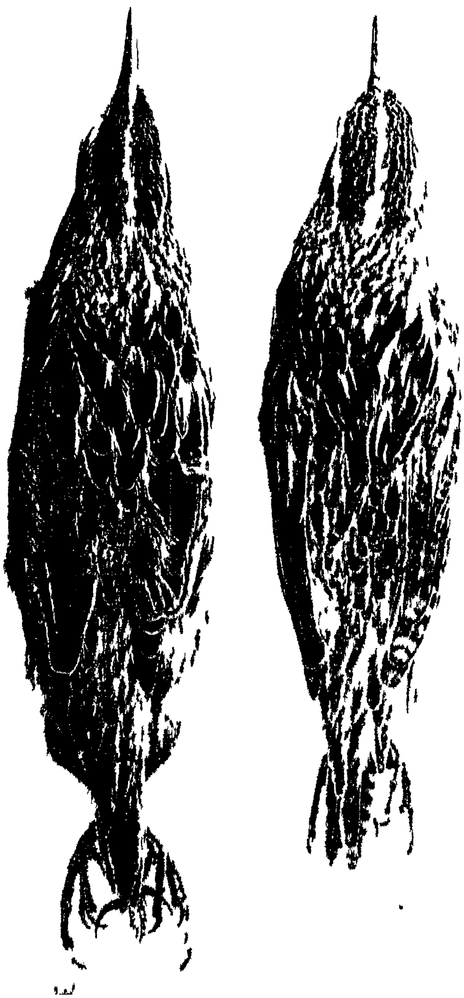


Fig. 1. Left-hand figure, *Sturnella magna*, Am. Mus. No. 25304, ♂, Sayville, L. I., Oct. 1880, E. A. Mearns. Right-hand figure, *Sturnella magna neglecta*, Am. Mus. No. 52417, ♂, Verde, Ariz., Nov. 23, 1885, E. A. Mearns. Showing differences in pattern, and, approximate intensity of color.

America do not differ appreciably from others from the northern United States. Southern specimens, as a rule, are darker in color and smaller in size, and, as is generally discovered when resident birds are compared with migratory ones of the same species, they have relatively longer tarsi.

Fig. 2. *Sturnella magna neglecta*, U. S. N. M. No. 127493, ♀, Aug. 14, 1892, San Bernardino Ranch, Ariz., E. A. Mearns. Showing abrasion and fading of plumage.

Geographical Variations of *Sturnella magna neglecta*.

Sturnella magna neglecta (Aud.).—Throughout its wide range the western Meadowlark exhibits surprisingly little variation in color. Pacific coast specimens from north of California are slightly darker than the normal, but the difference is inconstant or only evident when series are compared. This darker color is also shown by specimens from the *interior* of British Columbia, a fact which suggests the possibility of these birds having extended their range into this region from the coast. Specimens from along the Mexican border have no yellow on the sides of the throat, as will be noted below.

Sturnella magna hoopesi Stone.—Mr. Stone's type, a March bird from Brownsville, Texas, is perfectly typical of *neglecta*, except in the absence of yellow from the sides of the throat, and this character is shown by most of the specimens from the Mexican boundary line, east of the Rocky Mountains, which I have examined.

Summary.—In view of the wide extremes of climate and greatly diversified topography of the area occupied by *Sturnella magna neglecta* the bird is remarkably constant in color, no form of this bird, with the exception of *hoopesi*, ever having received a name, a statement which implies unusual stability in size and color!

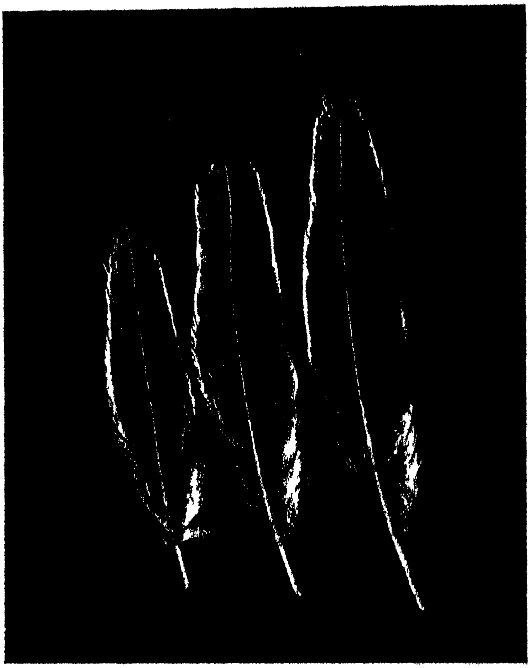


Fig. 3. Tertials of *Sturnella magna*, Am. Mus. No. 67300, Patchogue, L. I., Oct. 4, 1888, Clarence A. Smith.

Differences between *magna* and *neglecta*.

After this review of the geographical variations of *magna* and *neglecta*, *inter se*, we may approach the real problem of this paper, the inter-relationships of *magna* and *neglecta*. Are these birds representative, geographical, intergrading races of each other or are they specifically distinct? A satisfactory reply to this question is of the first importance, its bearing on related cases being far-reaching, and we can properly approach it only through a

clear understanding of the facts involved. In the first place, therefore, we may ascertain in detail the differences between typical examples of *magna* and *neglecta*.

Color.[1]— The essential differences in color between Arizona and New York Meadowlarks are as follows: In *magna* the

Fig. 4. Tertials of *Sturnella magna neglecta*, Am. Mus. No. 52423, ♂, Ft. Verde, Ariz., Dec. 26, 1887, E. A. Mearns.

median and post-ocular stripes, the sides of the head and neck, margins of the feathers of the back, wings, and tail, the flanks, thighs, and under tail-coverts are mostly ochraceous; in *neglecta* they are cream-buff. In *magna* the black markings occupy a larger part of the feathers in which they appear than in *neglecta*, in which the brown areas are proportionately increased. In *magna* these brown areas are chestnut-russet; in *neglecta*, broccoli brown and raw umber. In *magna* the yellow averages deeper, and this difference is intensified by the ochraceous instead of the cream-buff fringe to the feathers of the underparts.

[1] *Cf.* Ridgway's 'Nomenclature of Colors.'

For five months after the post-nuptial molt is completed, in September, the differences in color above mentioned are perfectly diagnostic but later in the year they are less tangible.

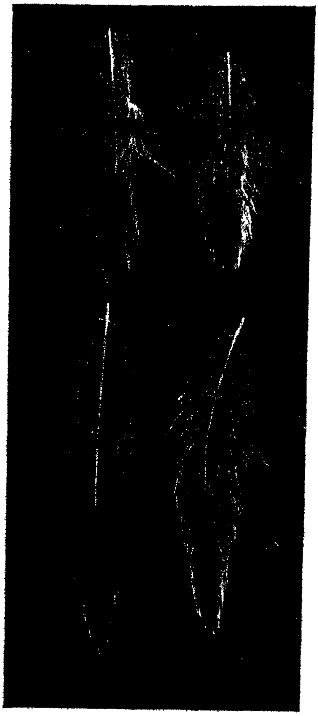


Fig. 5. Left-hand figures, rump feather and upper tail-covert of *Sturnella magna*, Am. Mus. No. 67300, ♂, Patchogue, L. I., Oct. 4, 1888, Clarence A. Smith. Right-hand figures, rump feather and upper tail-covert of *Sturnella magna neglecta*, Am. Mus. No. 52418, ♂, Ft. Verde, Ariz., Nov. 25, 1884, E. A. Mearns.

Pattern.—Comparison of freshly plumaged specimens of *magna* and *neglecta* presents the following differences in pattern of marking: In *neglecta* the feathers of the interscapular region are more often crossed by two or three generally incomplete bars than in *magna*, but in both forms there is much variation in this respect. In *neglecta* the basal black of these feathers is more frequently laterally spotted with brown than in *magna*. In breeding birds the subapical bars have generally disappeared through abrasion, but in *neglecta* the incipient lateral bars are usually evident. In the tertials, and, more especially, the rump, upper tail-coverts, and median tail-feathers, the bars are much better defined and more constant in *neglecta*, the pattern of marking of the three last named areas, taken together, constituting the best single character separating the two birds, the differences in the disposition of the black color in the feathers of these areas being well shown by the accompanying photographs, Figs. 3–7. In *neglecta* spots on the sides and flanks average rounder, and the yellow of the throat spreads laterally to the malar region. In adult males the latter character is constant and characteristic except along our Mexican boundary (see *antea* under *S. m. hoopesi*).

Young birds.—Young birds, in juvenal plumage, present essentially the same differences in color which distinguish the adults

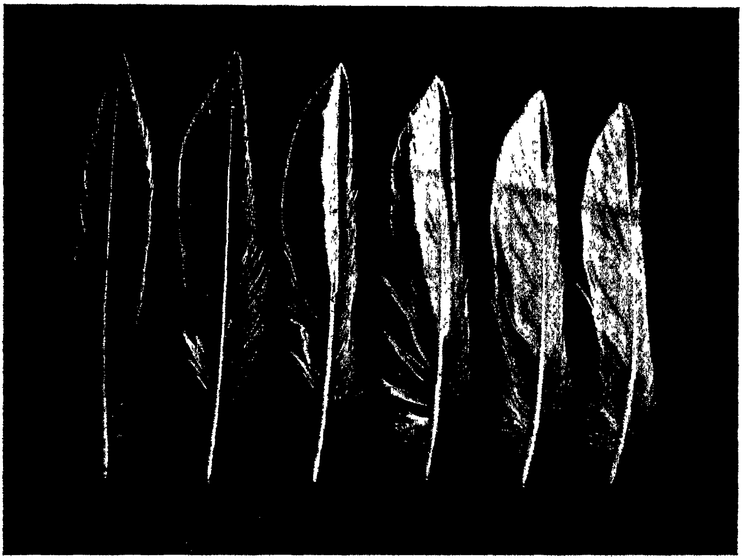


Fig. 6. Tail-feathers of *Sturnella magna*, Am. Mus. No. 67300, ♂, Patchogue, L. I., Oct. 4, 1888, Clarence A. Smith.

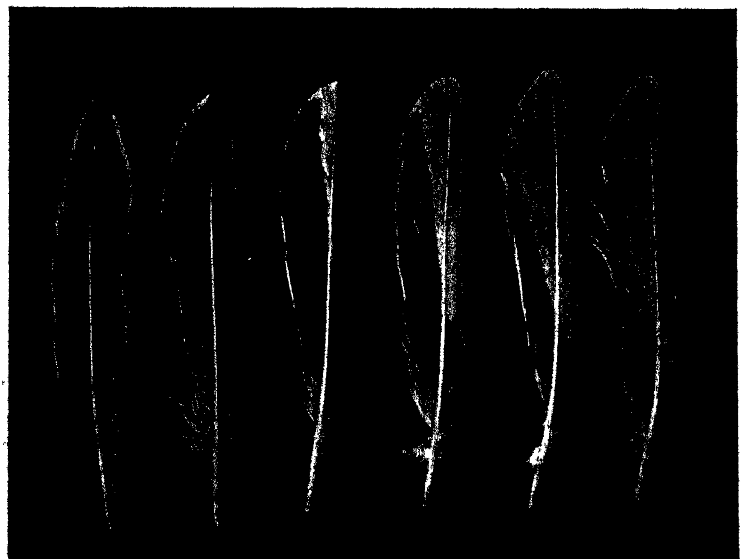


Fig. 7. Tail-feathers of *Sturnella magna neglecta*, Am. Mus. No. 52423, ♂, Ft. Verde, Ariz., Dec. 26, 1887, E. A. Mearns.

In pattern, however, it is worthy of special note that in this plumage the median tail-feathers and coverts in *magna* show a strong tendency toward the barred pattern of *neglecta;* five out of fourteen specimens of *magna* agreeing with *neglecta* in this respect, while of five young specimens of *mexicana* all have the tail-feathers and coverts barred as in *neglecta;* a fact which suggests that the barred type of marking is the older.

Fig. 8. Upper figures, interscapular feathers of *Sturnella magna*, at left, Am. Mus. No. 49229, ♂, Morristown, N. J., Oct. 3, 1886, E. C. Thurber; at right, Am. Mus. No. 69696, ♂, Trenton, N. J., May 29, 1886, M. M. Green. Lower figures, interscapular feathers of *Sturnella magna neglecta*, at left, Am. Mus. No. 52416, ♂, Ft. Verde, Ariz., Nov. 23, 1884, E. A. Mearns; at right, No. 52413, ♂, Yavapai Co., Arizona, Mch. 18, 1884, E. A. Mearns. To show seasonal abrasion.

Seasonal change in color and pattern.—The fact that Meadowlarks have only a post-nuptial molt and that when the breeding season arrives, wear and fading have deprived their plumage of its most characteristic colors and markings, greatly complicates the study of their relationships. The fall molt is concluded in September and from that month until January there is not sufficient change in plumage to interfere with the proper identification of specimens. After January, however, fading and wear often so alter a bird's appearance that its identity cannot be determined with certainty. It follows, therefore, that the differential characters of these birds are best exhibited in the fall and are least apparent in the breeding season, an unfortunate condition of affairs as every systematist will readily recognize.

Song.—Some advocates of the specific distinctness of the eastern and western Meadowlarks have attached much importance to the marked and well-known differences in the songs of these birds, and while these differences are doubtless of value in making field identifications, they should not, I think, be given

importance by the systematist. Song is largely if not wholly an uninherited character and is subject to great individual and geographical variation. In both *magna* and *neglecta* this statement is unusually well illustrated by the wide range of variation occurring in their respective songs. Dozens of strikingly different songs of *neglecta* have been recorded, its vocal powers have been described as being "a husky whistle" and as excelling those of the Nightingale; and while this difference is no doubt partially in the ear of the hearer, it nevertheless attests a wide range of variability.

Similar differences are to be observed in the eastern Meadowlarks. The song of about one tenth of the birds in south Florida is decidedly unlike that of the average type of song of the northern Meadowlark, and is said to approach that of *neglecta*. In Cuba, however, although the Cuban bird so closely resembles the southern Florida form, the Meadowlark song is only a wheezy chuckle, resembling more the song of a Dickcissel than that of a Meadowlark, though, as I have lately been informed by Mr. William Palmer, it improves toward midsummer.

If we were to rely on song, therefore, we should suppose the southern Florida and Cuban birds to be widely separated, whereas they are closely related.

RELATIONSHIPS OF *magna* TO *neglecta*.

Having ascertained the characteristics of *magna* and *neglecta* and the differences between typical representatives of these two forms we are prepared to approach the subject of their relationships by an examination of specimens from the area where their ranges come together.

Minnesota.[1]

Fort Snelling.—*S. magna*, Am. Mus. Nos. 55706–55709, April 17, four specimens; No. 55710, April 23; No. 55699, May 8; No. 55711, May 18.

[1] *Explanation of Abbreviations.*

Am. Mus. = American Museum of Natural History.
B. S. = Biological Survey.
F. M. C. = Coll. Frank M. Chapman.
G. B. S. = Coll. George B. Sennett.
O. B. = Coll. E. A. and O. Bangs.
U. S. N. M. = U. S. National Museum.
W. B. = Coll. William Brewster.

S. m. neglecta, Am. Mus. No. 55714, April 14; No. 55705, April 17; No. 55715, May 15; No. 55716, May 31; No. 55705, Oct. 17.

Non-typical specimens: Am. Mus. No. 55712, ♂, May 18, has the tail of typical *neglecta*, but the tail-coverts, rump, and rest of the plumage are those of true *magna*. Am. Mus. Nos. 55702, 55704, 55713, all males taken September 30, approach *neglecta* in the pattern of tail markings and in being somewhat paler than average *magna*. Am. Mus. No. 55703, ♂, September 30, approaches *neglecta* more closely than the preceding, in the pattern of the tail, tail-coverts, and rump, and in color; in fact, it may be described as one-third *neglecta* and two-thirds *magna*. This exceedingly interesting and important Fort Snelling series was collected by Dr. E. A. Mearns, who writes me concerning the manner of occurrence of Meadowlarks at Fort Snelling as follows: "This locality has two floras, Campestrian along the Minnesota River and Alleghanian (or Transition mixed with Canadian) in the Mississippi Valley. Fort Snelling is at the junction of these rivers, and the small reservation has a correspondingly great variety of plant-life. Driving toward Minneapolis one has the dry plains on the left and the alluvial river-bottom, with Pine Island, etc., on the right. *Sturnella neglecta* occupies and breeds in the former and *Sturnella magna* in the latter. I have often heard the totally distinct songs of both species at once when driving along this road."

Madison.—U. S. N. M. No. 127566, ♂, April 10; *neglecta* approaching *magna* in the pattern of its tail and its coverts.

Wisconsin.

Camp Douglas.—*Magna*, Am. Mus. No. 55700, ♂, July 15; *neglecta*, Am. Mus. No. 55701, ♀, juv.

Iowa.

Magna, Am. Mus. No. 36504, Spring; no locality. Mitchell Co., U. S. N. M. No. 28077, Aug. 1.

Nebraska.

Ft. Kearney.—*Magna*, U. S. N. M. No. 13054, June 20; *neglecta*, B. S. No. 139409, Sept. 9.

Republican Fork.—*Magna*, U. S. N. M. No. 170735, May 24.
Loup Fork.—*Magna*, U. S. N. M. No. 9319, Aug. 3, juv.; *neglecta*, U. S. N. M. No. 9318, July 28, juv., No. 9309, July 27.
Omaha.—*Neglecta*, U. S. N. M. No. 88102, March 14, ♂; No. 159366, April 19, ♀; No. 159367, April 19, ♂.
Columbus.—*Neglecta*, B. S. No. 139402, Aug. 27, juv.
Ft. Union.—*Neglecta*, U. S. N. M., No. 5342, July 19.
Pole Creek.—*Neglecta*, U. S. N. M., July 18.
Valentine.—*Neglecta*, B. S. No. 155878, ♂, April 25.

Kansas.

Council Grove.—*Magna*, Am. Mus. No. 26776, ♀, July 2.
Belle Plaine.—*Magna*, B. S. No. 139423, ♂, July 23.
Cairo.—*Magna*, B. S. No. 139433, ♂, Aug. 1; B. S. No. 139424, July 30.
Trego Co.—*Neglecta*, W. B. No. 11310, May, 1889; B. S. Nos. 139413, 139404, 139432.
Garden City.—*Neglecta*, Am. Mus. Nos. 36752, 36762, Sept. 30.

Missouri.

Golden City.—B. S. No. 142087, ♂, July 13, *S. magna* apparently approaching *neglecta*, but in too worn plumage to be satisfactorily determined. B. S. No. 139430, July 13, juv. Apparently intermediate; the central tail-feathers abnormally marked with white.

Indian Territory.

18 miles west of Cable.—*Magna*, U. S. N. M. No. 19102, ♂, May 30.
Ft. Gibson.—*Magna*, B. S. No. 139429, ♂, June 18.
Hartshorne.—*Magna*, B. S. No. 139426, ♀, Aug. 29.
Savanna.—*Magna*, B. S. No. 139427, ♀ juv., Aug. 23.

Texas.

Gainsville.—*Magna*, Aug. 12, two males, one female; Aug. 8, ♀. March 21, ♂, *magna*, approaching *neglecta* in paleness and closely resembling it in the pattern of the tail, tail-coverts, and rump; an evident intermediate.

Henrietta.—*Magna*, B. S., April 13, ♂, typical in all respects except in pattern of the tail, tail-coverts, and rump which are more barred than in average *magna*. B. S., April 11, ♂, *neglecta*, typical.

Concerning the Meadowlarks of Henrietta, Mr. Harry C. Oberholser writes me: "During the summer of 1900 both species (*Sturnella magna* and *S. neglecta*) were found at Henrietta, Texas, in the proportion of about eight or ten of the former to one of the latter. They inhabited often the same ground, apparently fraternizing freely; and both were leading young late in June. The song of each was always easily distinguishable and perfectly characteristic."

Vernon.—*Neglecta*, B. S., April 27, ♂.

Corpus Christi.—A series of thirty specimens from Corpus Christi collected in the spring of 1891 proves of exceptional interest; indeed, I may add, it was the attempt to name these birds which involved me in a study of this genus. Both the *magna* and *neglecta* types of Meadowlark are present in the Corpus Christi region. The former is the breeding bird in the immediate vicinity of the town on the coast, where, in April, I found it to be common and heard many individuals (some of which were collected) sing the characteristic song of *magna*. True *neglecta* apparently does not breed at Corpus Christi but, like certain other western forms,—*Pyrocephalus* for example,—it may possibly be found breeding about fifteen miles west of the town up the Nueces Valley. This, however, is a mere supposition to account for the presence of brown-billed, apparently non-breeding specimens of *neglecta* in April and May, and, more especially, of intermediates.

An analysis of this series presents the following result.

Magna, ten specimens, eight males, two females, April 14 to 23. These birds agree very well in color with average eastern specimens of *S. magna*, but it is interesting to observe that, although from further south, they are larger than specimens from the coast of Louisiana. In length of wing they resemble examples from Illinois, the tarsus and bill, however, being somewhat longer.

The exceedingly close resemblance between these birds and two May males in Mr. Sennett's collection from Xicotencatl, near Tampico, shows, as might be expected, that they are the

northern representatives of *mexicana*, which here appears to be restricted to the humid coast region.

Neglecta.—Twelve specimens, including two females, March 19 and 31; two males, six females, April 7 to 16; two specimens (unsexed) May. None of these specimens has the blue bill of a breeding bird and all but one have the throat-patch fringed with ashy. The extent of yellow on the side of the throat is not very clearly defined; in this respect some specimens agree with typical *neglecta*, others with *hoopesi*.

Intermediates.—The extremes mentioned above under the names *magna* and *neglecta* are connected by a series of intermediates to which, for one reason or another, I would refer eight of the thirty Corpus Christi specimens. They may be described as follows: Am. Mus. No. 67308, ♂, April 1; pattern of back, rump, and tail as in *neglecta*, color above as in *magna* but more ruddy in tone; yellow confined to throat. Am. Mus. No. 54952, ♀, April 2; pattern of back and rump as in *neglecta;* tail intermediate in pattern; color above as in *magna* but more ruddy in tone; yellow confined to throat. Am. Mus. No. 54947, ♀, April 14; above intermediate in pattern and color; yellow inclined to extend to the malar region. Am. Mus. No. 54950, ♂, April 14; in pattern, color, and extent of yellow on the malar region fairly intermediate between *magna* and *neglecta*. This bird has the blue bill of a breeding bird and was found associated with *magna*. Am. Mus. No. 67312, ♀, April 16; above, pattern of *neglecta* but intermediate in color; yellow confined to the throat. Am. Mus. No. 67320, ♂, April 23; interscapulars intermediate in pattern; rump and tail with pattern of *neglecta;* color approaching that of *magna*, yellow confined to throat. Am. Mus. No. 67321, ♀, April 23; pattern of back and rump as in *neglecta*, tail intermediate; yellow confined to throat; color of *magna*. G. B. S. No. 3452, May; intermediate in pattern; color of *magna;* yellow confined to throat.

Opinion would no doubt vary in regard to the exact determination of these specimens, but as a series there can be no doubt that they prove the complete intergradation of *magna* and *neglecta* in southeastern Texas. Whether this intergradation is geographical, that is, correlated with climatic conditions, or whether it is due to the interbreeding of typical examples of

magna with typical examples of *neglecta*, can only be determined by further field work.

The scarcity of breeding birds and of field observations from our Mexican border is greatly to be deplored, for here it is that the status of *hoopesi* and its relationships to *magna* and *mexicana* are to be determined. However, the specimens at hand are listed as follows:

Brownsville.—*Magna*, B. S. No. 139388, August 4. *Hoopesi*, U. S. N. M. No. 74327, August 21; Josiah Hoopes Coll. No. 786, ♂, March 13 (type of *hoopesi*).

Rio Grande City.—*Neglecta*, G. B. S. No. 1470, ♂, April 2; bill brown, yellow extending to malar region; apparently not a breeding bird.

Lomita.—*Neglecta*, G. B. S. No. 1469, ♀; yellow extending slightly on sides of the throat.

Laredo.—*Mexicana*, G. B. S. No. 3455, March; G. B. S. No. 3456, ♀, March; G. B. S. No. 3454, ♂, March.

Altuda.—*Mexicana*, B. S. No. 139389, August 9.

Marfa.—*Mexicana*, G. B. S. No. 5056, ♂, July 11; G. B. S. No. 5057, ♀, July 11.

The narrow pectoral crescent of these Marfa specimens places them with *mexicana* rather than with *magna* but their plumage is too worn to permit of a satisfactory understanding of their relationships with *neglecta*.

Pecos City.—*Mexicana*, G. B. S. No. 4832, ♂, June 2; G. B. S. No. 4833, ♀, June 2. Both specimens have the color and narrow pectoral crescent of *mexicana* but in the pattern of the back, rump, and tail they resemble *neglecta*; the yellow is confined to the throat.

New Mexico.

San Bernardino Ranch.—*Mexicana*, U. S. N. M. No. 127492, ♂, Aug. 4; *hoopesi*, U. S. N. M. No. 127823, ♂, Aug. 3; U. S. N. M. No. 130504, ♂, Aug. 18; U. S. N. M. No. 130503, ♂, Aug. 24. Yellow confined to the throat.

Mexico.

Chihuahua, San Diego.—*Mexicana*, Am. Mus. No. 56792; no date, worn breeding plumage, bill blue; Am. Mus. No.

56793; worn breeding plumage, bill blue. Four other specimens from this locality, two taken in September and two in February, are referable to *hoopesi*; or, in other words, are *neglecta* without yellow on the malar region.

Coahuila, Saltillo.—*Neglecta*, B. S. No. 144506, ♀ jvr., August 17.

Coahuila, Carneros.—*Neglecta*, B. S. No. 144507, ♂, August 12. Sides of throat yellow.

Tamaulipas, Miquihuana.—*Neglecta*, B. S. No. 158880, ♀, June 7. Sides of throat yellow.

Tamaulipas, Xicotencatl.—*Magna*, G. B. S. No. 7384, ♂, May 10; G. B. S. No. 7385, ♂, May 13.

These birds agree exactly with specimens of *magna* from Corpus Christi.

MEASUREMENTS OF MALES.

Atlantic Coast.

Locality.	When Collected.	Wing.	Tail.	Culmen.	Collection.	Number.
Brandon, Vt.,	Apl. —	4.90	1.60	1.35	U. S. N. M.	159684
Amherst, Mass.,	" 8	4.75	1.50	1.28	"	128914
Barnstable, "	" 4	4.92	1.70	1.32	O. B.	36
Fishkill, N. Y.,	" 18	4.65	1.60	1.32	Am. Mus.	25305
Springs (L. I.), N. Y.,	" —	4.85	1.58	1.25	"	65446
Englewood, N. J.,	May 30	4.82	1.62	1.30	F. M. C.	88
Trenton, N. J.,	" 29	5.04	1.68	1.38	Am. Mus.	69696
Washington, D. C.,	June 4	4.98	1.62	1.40	U. S. N. M.	122043
" "	" 8	4.85	1.62	1.32	"	122044
Gainesville, Fla.,	May 20	4.47	1.40	1.20	F. M. C.	860
" "	" 19	4.37	1.40	1.22	"	848
Pellicier's Creek, Fla.,	" 20	4.31	1.50	1.25	U. S. N. M.	133095
" " "	" 20	4.40	1.60	1.35	"	133096
Near Kissimmee "	Mch. 3	4.28	1.60	1.21	"	150023
" " "	" 3	4.20	1.56	1.20	"	150022
" " "	" 21	4.34	1.62	1.30	"	152058
Sebastian River, Fla.,	" 14	4.45	1.60	1.25	Am. Mus.	39033
" " "	" 12	4.30	1.55	1.23	"	39030
" " "	" 12	4.42	1.50	1.28	"	39031

Cuba.

Locality.	When Collected.	Wing.	Tail.	Culmen.	Collection.	Number.
Trinidad,	Mch. 18	4.00	1.46	1.25	Am. Mus.	57234
"	" 17	3.98	1.46	1.25	"	57233
"	" 23	3.98	1.46	1.23	"	57243
"	" 21	4.00	1.45	1.26	"	57241
"	" 17	3.97	1.45	1.28	"	57232

Mississippi Valley.

Locality.	When Collected.	Wing.	Tail.	Culmen.	Collection.	Number.
Fort Snelling, Minn.,	May 8	4.75	1.48	1.25	Am. Mus.	5699
" "	" 18	4.95	1.62	1.31	"	55711
" "	" 18	4.92	1.53	1.18	"	55712
Erie, Pa.,	Mch. 31	4.88	1.51	1.41	G. B. S.	51465
" "	Apl. 14	4.98	1.55	1.25	"	1467
" "	" 16	4.75	1.50	1.40	"	1468
Sugar Creek Prairie, Ills.,	June 3	4.50	1.41	1.28	U. S. N. M.	118461
" "	" 7	4.60	1.45	1.22	"	133317
" "	" 3	4.90	1.36	1.28	"	118462
Gibson, Ind.,	Apl. 10	4.62	1.50	1.30	W. B.	12804
Golden City, Mo.,	July 13	4.60	1.58	1.28	B. S.	142087
Ft. Gibson, Ind. Terr.,	June 18	4.80	1.58	1.28	"	139429
Iowa Station, La.,	Apl. 8	4.32	1.60	1.25	"	164802
Avery's Island, La.,	June 10	4.40	1.62	1.28	U. S. N. M.	150735
" "	" 10	4.25	1.58	1.28	"	150736
" "	" 11	4.40	1.58	1.26	"	150734
Corpus Christi, Tex.,	Apl. 14	4.65	1.55	1.40	Am. Mus.	67306
" "	" 14	4.55	1.65	1.32	"	67311
" "	" 23	4.55	1.66	1.35	"	67319
" "	" 14	4.55	1.69	1.35	"	54951
" "	" 23	4.70	1.70	1.38	"	67320
" "	" 14	4.80	1.65	1.35	"	54949
" "	" 14	4.78	1.70	1.38	"	54948

Mexico and Southward.

Locality.	Wing.	Tarsus.	Culmen.	Collection.	Number.
Chihuahua, San Diego,	4.84	1.50	1.30	Am. Mus.	56792
Durango, Papasquiaro,	4.90	1.52	1.24	B. S.	164019
Tepic, Santiago,	4.48	1.52	1.19	"	157472
" Tepic,	4.55	1.55	1.22	"	156064
Guanajuato,	4.78	1.65	1.22	U. S. N. M.	105269
"	4.65	1.50	1.19	"	74350
Jalisco, Etzatlan,	4.65	1.70	1.30	B. S.	144526
" Mesquitic,	4.60	1.55	1.21	"	156969
Puebla, Metaltoyuca,	4.40	1.63	1.24	"	158882
Orizaba,	4.35	1.58	1.15	U. S. N. M.	42502
Jalapa,	4.25	1.61	——	"	13653
"	4.20	1.62	1.21	Am. Mus.	42254
"	4.35	1.55	1.20	"	42257
Tamaulipas, Xicotencatl,	4.65	1.60	1.26	G. B. S.	7385
" "	4.65	1.45	1.25	"	7384
Vera Cruz, Minatitlan,[1]	4.04	1.56	1.10	B. S.	144519
" "	4.14	1.62	1.22	"	144516

[1] *Sturnella magna inexpectata.*

Locality.	Wing.	Tarsus.	Culmen.	Collection.	Number.
Vera Cruz, Minatitlan,	4.00	1.61	1.15	B. S.	144518
" "	4.10	1.60	1.17	"	144523
Oaxaca, Tapana,	4.60	1.69	1.20	"	144510
Chiapas, Ocuilapa,[1]	4.56	1.68	1.24	"	144524
" "	4.56	1.70	1.18	"	144512
" "	4.65	1.66	1.20	"	144514
Chiapas, San Cristobal,	4.40	1.62	1.18	"	144503
" "	4.35	1.48	1.12	"	144501
Guatemala, Hda. Chaucol,	4.46	1.50	1.18	"	144522
" Dueñas,	4.45	1.75	1.18	U. S. N. M.	33604
Honduras (coast region ?),[2]	3.96	1.48	1.12	"	50524
" "	4.00	1.45	1.12	"	11981
" Segovia River,[2]	3.85	1.44	1.10	"	112126
" " "[3]	3.81	1.51	1.15	"	112127
Costa Rica, San Jose,	4.38	1.50	1.18	"	33380
" "	4.30	1.62	1.22	"	42897
Venezuela, Valencia,	4.50	1.64	1.40	"	153885
Colombia, 'Bogota,'	4.52	1.62	1.40	Am. Mus.	35382
" "	4.50	1.65	1.40	"	36666
" "	4.65	1.70	1.50	U. S. N. M.	147159

British Columbia and Pacific Coast.

Locality.	When Collected.	Wing.	Tarsus.	Culmen.	Collection.	Number.
Clinton, B. C.,	July 6	5.05	1.50	1.30	Am. Mus.	30994
Ashcroft "	June 4	5.22	1.50	1.25	"	30989
Comox "	" 4	5.11	1.54	1.35	B. S.	39400
New Westminster, B. C.,	May 22	4.80	1.44	1.40	Am. Mus.	47579
Vancouver, Washington,	Apl. 13	4.98	1.51	1.28	"	57697
Ft. Walla Walla, "	Feb. 13	4.86	1.42	1.25	"	42251
Ft. Klamath, Oregon,	May 27	4.90	1.46	1.22	"	25306
" "	Spring	5.10	1.52	1.35	"	54796
Red Bluff, Calif.,	Mch. 24	5.05	1.51	1.30	"	98346
Calito, "	May 3	4.82	1.49	1.26	"	152611
Nicasio, "	Apl. 23	4.80	1.48	1.28	U. S. N. M.	83852
Owen Lake, "	June 9	4.88	1.51	1.25	B. S.	139405
Death Valley, Calif.,	June 19	4.88	1.50	1.31	"	139406
Jacumba, "	May 26	5.00	1.50	1.35	U. S. N. M.	133902
" "	" 26	4.88	1.52	1.24	U. S.	133624
" "	" 26	5.00	1.52	1.25	"	133900
" "	" 26	5.00	1.46	1.35	"	60948

Summary.—It appears from this review of the available material from the regions where the ranges of *neglecta* and *magna* come together, that in the Mississippi Valley, between the meridians of 90° and 100°, both *magna* and *neglecta* are typically

[1] Type of *Sturnella magna alticola.*
[2] *Sturnella magna inexpectata.*
[3] Type of *Sturnella magna inexpectata.*

represented, that they are sometimes found associated during the breeding season, that their ranges overlap for a distance of several hundred miles, and that intermediates between them, while not proportionately common, do occur, sometimes in connection with typical representatives of both forms.

In southeastern Texas, at Corpus Christi, the fusion of these birds seems to be more complete, though it is not probable that both forms breed there.

On our Mexican boundary, east of the Rocky Mountains, *neglecta*, as a whole, shows an approach to the *magna* type in the absence, usually, of yellow from the sides of the throat. Specimens of *magna* in the lower Rio Grande, and of *mexicana* further west, also occur in this region, and there are also intermediates between the two forms and *neglecta*. Specimens, however, are lacking to show the exact relationships of *mexicana* to *neglecta*, or to its representative *hoopesi*.

Conclusions. — Before proceeding further I take pleasure in acknowledging the assistance which Mr. E. W. Nelson has rendered me in explaining certain apparently anomalous cases in the distribution of Meadowlarks in northern Mexico. Mr. Nelson's unequalled field experience in Mexico has given him that knowledge of the topography and climate of the country which is so essential to a proper understanding of the distribution and geographical variation of species, and until he had informed me of the climatic conditions prevailing at certain places, I was at loss to account for the occurrence there of birds included in the collections studied.

As has been previously stated, the material available for examination is not of a nature to permit of wholly satisfactory conclusions being drawn from it. It, however, warrants the presentation of a theory which further research must prove or disprove.

Assuming that Meadowlarks originated in the humid tropics, we have, as the ancestral form, a dark bird which, spreading northward along the coast and over the Mexican tablelands, retained its dark colors in humid regions and acquired a paler color in arid regions. The *neglecta* type originated, therefore, in arid portions of the tableland of Mexico, where its range is bounded on the south by the humid valley of Mexico. On either

side of the tableland it is flanked by a northward extension of the range of *mexicana* along the humid portions of the Sierra Madre, as is shown by the occurrence of dark birds at San Diego in Chihuahua, and perhaps also in the humid mountainous region of western Texas.

Breeding specimens of *neglecta* from the southern parts of the tableland or areas adjoining the Sierras are wanting to show the relationships of the birds in these regions, but it is probable that where an arid region passes into a humid region *neglecta* passes into *mexicana*, as is suggested by the intergradation of specimens at Corpus Christi.

The absence of proper material and of field observations also prevents us from determining whether the specimens of *neglecta* from our southern boundary, which lack yellow on the sides of the throat, and which Mr. Stone has named *hoopesi*, are, as might be supposed, a step in the differentiation of the light bird from the dark one.

The extension of the range of the dark bird northward along the narrow strip of humid coast region is well shown by specimens from near Tampico and from Corpus Christi. A further advance northward has probably been made, as in the case of other specimens still largely restricted to it — *e. g.*, *Quiscalus macrourus* — along the coast region and perhaps up the Mississippi Valley until it has eventually occupied the United States east of the one hundredth meridian.

The extension of the range of the light bird has been northward over the tableland into the western United States, and would appear to have been comparatively rapid, since it is now found occupying humid regions without as yet evincing any decided change in color.

If the assumption of the origin of both birds from a common ancestor be accepted and if their geographical intergradation at the southern limits of the range of *neglecta* be established, we are then in a position to explain their apparent association as species in the more northern parts of their range, on the ground that while their ranges originally diverged like forks of a Y, the ends have finally come together, not as geographical intergrades, but as two forms, both of which have occupied the region where they are found associated at so recent a date that neither shows

the effect of the climatic conditions under which it lives, but exhibits the characters earlier acquired.

In the Mississippi Valley, therefore, we have the apparent anomaly of two geographical races or subspecies of the same species breeding at the same place, and, occasionally associated with them, are certain intermediate specimens showing in varying degrees the characters of both extremes.

Since it is out of the question to suppose that the same environment could produce three phases of the same species at the same place, that is, *neglecta*, *magna*, and intermediates between the two, we can only suppose that such connecting specimens are not geographical intergrades but the results of a union between *neglecta* and *magna*. In fact, loosely speaking, these connecting specimens would be termed hybrids, but, accepting as a definition of this word "the offspring of animals of different *species*," it is evident that in a strict sense it cannot be applied to these intermediates, which are the progeny of parents not specifically distinct.

While it is greatly to be regretted that the present paper cannot be more conclusive, it is hoped that the theory herein advanced, of the descent from a common ancestor of both *magna* and *neglecta*, of their continued geographic or climatic intergradation on the Mexican tableland, of their independent range extension northward and subsequent meeting and interbreeding in the Mississippi Valley, may at least prove suggestive to students of the genus *Sturnella*.

It remains to acknowledge my indebtedness for the loan of the material on which this paper has been so largely based, and I therefore very gladly express my thanks to Mr. Robert Ridgway, Dr. C. Hart Merriam, Mr. William Brewster, Mr. Witmer Stone, Dr. Louis B. Bishop, and Mr. Outram Bangs for their kindness in sending the specimens included in the appended statement.

Specimens Examined.—Collection of United States National Museum, through Robert Ridgway, Curator of Birds, 315; American Museum of Natural History, 240; Biological Survey, through Dr. C. Hart Merriam, Chief of the Survey, 84; George B. Sennett, 37; William Brewster, 25; Philadelphia Academy of Natural Sciences, through Witmer Stone, Conservator of Birds, 21; Outram Bangs, 6; Louis B. Bishop, 6. Total, 734.

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[New names of genera, species, and subspecies are printed in **heavy-faced** type.]

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